CHAPTER 8

POWER DEVELOPMENT PLAN

CHAPTER 8 POWER DEVELOPMENT PLAN

INPUT DATA for ESPRIT (Chapter-8)

TABLE 2.1.1 PARAMETER OF EXISTING POWER PLANTS OF NORTH

NO.	PLANT NAME	NO. OF UNIT	PLANT TYPE	CAPACITY (MW)	BASE LOAD (MW)	HEAT RATE *) BASELOAD (KCAL/KWH)	HEAT RATE *) INCR'TAL (KCAL/KWH)	FUEL COST DMSTIC ($/KCAL)	FUEL COST FORGN ($/KCAL)	FAST SPIN RES. (%)	FOR (%)	SCHL MAIN (DAYS)	MAIN CLAS (MW)	O & M FIXED ($/KW/M)	O & M VAR ($/MWH)
1	HTHAC BA	1	HYDR	108	11	0	0	0.0	0.0	0	0.5	0	0	0.0	0.0
2	HHOA BIN	1	HYDR	1920	192	0	0	0.0	0.0	0	0.5	0	0	0.0	0.0
3	CNINH BI	4	COAL	25	8	4870	4090	4.54	0.0	5	20.0	50	25	1.1	6.2
4	CUONG BI	2	COAL	50	16	4214	3540	4.54	0.0	5	20.0	50	50	1.1	6.2
5	CPHA LAI	4	COAL	110	38	3541	3001	4.54	0.0	6	15.0	50	100	0.9	5.0
6	CPHA LAB	0	COAL	300	105	2600	2400	4.54	0.0	6	8.0	40	300	0.3	1.9
7	GTHAI BI	2	GAST	14	5	5810	4395	4.76	0.0	0	10.0	40	14	0.2	9.2

TABLE 2.1.2 PARAMETER OF EXISTING POWER PLANTS OF SOUTH

NO.	PLANT NAME	NO. OF UNIT	PLANT TYPE	CAPACITY (MW)	BASE LOAD (MW)	HEAT RATE *) BASELOAD (KCAL/KWH)	HEAT RATE *) INCR'TAL (KCAL/KWH)	FUEL COST DMSTIC ($/KCAL)	FUEL COST FORGN ($/KCAL)	FAST SPIN RES. (%)	FOR (%)	SCHL MAIN (DAYS)	MAIN CLAS (MW)	O & M FIXED ($/KW/M)	O & M VAR ($/MWH)
1	HDA NHIM	1	HYDR	160	16	0	0	0.0	0.0	0	0.5	0	0	0.0	0.0
2	HTRI AN	1	HYDR	400	40	0	0	0.0	0.0	0	0.5	0	0	0.0	0.0
3	HTHAC MO	0	HYDR	150	15	0	0	0.0	0.0	0	0.5	0	0	0.0	0.0
4	HHAM/DAM	0	HYDR	472	47	0	0	0.0	0.0	0	0.5	0	0	0.0	0.0
5	LPHU MYL	0	LNGP	200	60	2450	2040	7.49	0.0	6	7.0	30	200	0.4	2.3
6	OCAN THO	1	OILE	33	10	3250	2785	7.49	0.0	6	6.0	20	30	0.5	2.8
7	OTHU DU1	1	OILE	33	10	3098	2634	7.49	0.0	6	6.0	30	30	0.5	2.8
8	OTHU DU2	2	OILE	66	10	3098	2634	7.49	0.0	6	6.0	30	50	0.5	2.8
9	GTHU DGO	1	GAST	33	7	4210	3285	7.49	0.0	8	10.0	40	33	0.2	9.1
10	GTHU DGN	2	GAST	32	10	3630	2180	7.49	0.0	6	6.0	30	30	0.2	9.1
11	GBARIA O	2	GAST	15	7	4145	3140	7.49	0.0	8	10.0	40	15	0.2	9.2
12	GBARIA N	2	GAST	32	10	3630	2180	7.49	0.0	6	6.0	30	32	0.2	9.2
13	DDIESEL2	1	DSEL	78	0	3000	2800	7.49	0.0	8	10.0	20	20	0.4	3.5
14	GAS C/C1	0	COMB	400	100	1911	1800	7.94	0.0	8	6.0	35	400	0.3	4.0
15	GAS C/C2	0	COMB	200	100	1911	1800	7.94	0.0	8	6.0	35	200	0.3	4.0

TABLE 2.1.3 PARAMETER OF EXISTING POWER PLANTS OF CENTER

NO.	PLANT NAME	NO. OF UNIT	PLANT TYPE	CAPACITY (MW)	BASE LOAD (MW)	HEAT RATE *) BASELOAD (KCAL/KWH)	HEAT RATE *) INCR'TAL (KCAL/KWH)	FUEL COST DMSTIC ($/KCAL)	FUEL COST FORGN ($/KCAL)	FAST SPIN RES. (%)	FOR (%)	SCHL MAIN (DAYS)	MAIN CLAS (MW)	O & M FIXED ($/KW/M)	O & M VAR ($/MWH)
1	HSMALL	1	HYDR	19	2	0	0	0.0	0.0	0	0.5	0	0	0.0	0.0
2	HVINH SO	0	HYDR	66	7	0	0	0.0	0.0	0	0.5	0	0	0.0	0.0
3	HYARI12	0	HYDR	360	35	0	0	0.0	0.0	0	0.5	0	0	0.0	0.0
4	HYARI34	0	HYDR	360	35	0	0	0.0	0.0	0	0.5	0	0	0.0	0.0
5	HSONG HI	0	HYDR	70	7	0	0	0.0	0.0	0	0.5	0	0	0.0	0.0
6	DDIESEL3	1	DSEL	177	0	3000	2800	15.00	0.0	6	10.0	20	20	0.4	3.5
7	DDIESEL4	0	DSEL	300	0	3000	2800	15.00	0.0	6	10.0	20	20	0.4	3.5

TABLE 3.1.1 PARAMETER OF CANDIDATE POWER PLANTS OF NORTH

NO.	PLANT NAME	NO. OF UNIT	PLANT TYPE	CAPACITY (MW)	BASE LOAD (MW)	HEAT RATE *) BASELOAD (KCAL/KWH)	HEAT RATE *) INCR'TAL	FUEL COST DMSTIC ($/KCAL)	FUEL COST FORGN ($/KCAL)	FAST SPIN RES. (%)	FOR (%)	SCHL MAIN (DAYS)	MAIN CLAS (MW)	O & M FIXED ($/KW/M)	O & M VAR ($/MWH)	AVAIL' YEAR
1	HBAN	1	HYDR	350	50	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2002
2	HDAI	1	HYDR	250	25	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2002
3	HCUA	1	HYDR	105	10	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2003
4	HSON	1	HYDR	480	48	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2007
5	HSON	1	HYDR	480	48	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2008
6	HSON	1	HYDR	480	48	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2009
7	HSON	1	HYDR	480	48	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2010
8	HSON	1	HYDR	480	48	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2011
9	CQUA	1	COAL	300	105	2529	2400	4.54	0.0	6	8.0	95	300	0.7	4.0	2000
10	HHOU	1	HYDR	400	40	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2012
11	HHOU	1	HYDR	400	40	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2013

TABLE 3.1.2 PARAMETER OF CANDIDATE POWER PLANTS OF SOUTH

NO.	PLANT NAME	NO. OF UNIT	PLANT TYPE	CAPACITY (MW)	BASE LOAD (MW)	HEAT RATE *) BASELOAD (KCAL/KWH)	HEAT RATE *) INCR'TAL	FUEL COST DMSTIC ($/KCAL)	FUEL COST FORGN ($/KCAL)	FAST SPIN RES. (%)	FOR (%)	SCHL MAIN (DAYS)	MAIN CLAS (MW)	O & M FIXED ($/KW/M)	O & M VAR ($/MWH)	AVAIL' YEAR
1	HDAI	1	HYDR	300	30	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2003
2	HDON	1	HYDR	200	20	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2006
3	NEW	1	COMB	300	100	1911	1800	7.94	0.0	8	6.0	55	300	0.3	4.0	2000
4	NEW+	1	COAL	300	100	2529	2400	8.22	0.0	8	6.0	95	300	0.7	4.0	2008

TABLE 3.1.3 PARAMETER OF CANDIDATE POWER PLANTS OF CENTER

NO.	PLANT NAME	NO. OF UNIT	PLANT TYPE	CAPACITY (MW)	BASE LOAD (MW)	HEAT RATE *) BASELOAD (KCAL/KWH)	HEAT RATE *) INCR'TAL	FUEL COST DMSTIC ($/KCAL)	FUEL COST FORGN ($/KCAL)	FAST SPIN RES. (%)	FOR (%)	SCHL MAIN (DAYS)	MAIN CLAS (MW)	O & M FIXED ($/KW/M)	O & M VAR ($/MWH)	AVAIL' YEAR
1	HSE	1	HYDR	220	22	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2002
2	HBUO	1	HYDR	81	8	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2002
3	HSE	1	HYDR	366	40	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2006
4	HPLI	1	HYDR	120	12	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2001
5	HAN	1	HYDR	116	12	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2004
6	HSON	1	HYDR	60	6	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2005
7	HRAO	1	HYDR	80	8	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2007
8	HTHU	1	HYDR	260	30	0	0	0.0	0.0	0	0.0	0	0	0.0	0.0	2004

INPUT DATA for ESPRIT (Chapter-8)

TABLE 1.1.1 CHRONOLOGICAL LOAD CURVE (MW) OF NORTH

YEAR	PERIOD	TIME (H) 1	2	3	4	5	6	7	8	9	10	11	12
		13	14	15	16	17	18	19	20	21	22	23	24
1993	1	366	363	363	363	413	553	620	604	598	623	660	595
		519	534	547	569	690	865	957	881	760	628	430	392
	2	381	377	375	383	451	539	526	540	560	615	644	578
		527	537	548	561	637	715	913	883	794	696	482	415
	3	553	538	526	524	548	604	596	625	676	732	772	715
		676	676	685	694	741	791	1015	998	912	824	651	614
	4	384	382	381	383	470	595	589	594	603	637	662	581
		521	554	581	598	743	1077	1028	956	802	688	446	407
1994	1	393	389	389	389	443	593	665	648	642	668	708	638
		557	573	587	611	740	928	1027	945	815	674	461	421
	2	409	405	402	411	484	578	564	579	601	660	691	620
		565	576	588	602	684	767	980	947	852	747	517	445
	3	593	577	564	562	588	648	640	671	725	785	828	767
		725	725	735	745	795	849	1089	1071	979	884	699	659
	4	412	410	409	411	504	638	632	637	647	684	710	623
		559	594	623	642	797	1156	1103	1026	861	738	479	437

TABLE 1.1.2 CHRONOLOGICAL LOAD CURVE (MW) OF SOUTH

YEAR	PERIOD	TIME (H) 1	2	3	4	5	6	7	8	9	10	11	12
		13	14	15	16	17	18	19	20	21	22	23	24
1993	1	357	357	350	357	392	455	413	448	490	490	525	434
		427	469	469	511	539	700	679	623	609	560	441	357
	2	400	400	400	400	465	458	408	472	479	529	536	472
		465	429	486	501	529	565	715	679	651	615	515	408
	3	413	413	383	390	428	465	450	503	578	570	555	480
		488	525	540	540	540	570	750	720	713	645	495	443
	4	417	409	409	417	458	531	482	523	572	572	621	507
		498	547	547	596	629	817	792	727	711	654	515	417
1994	1	419	419	411	419	460	534	484	526	575	575	616	509
		501	550	550	599	632	821	796	731	714	657	517	419
	2	469	469	469	469	545	537	479	554	562	621	629	554
		545	503	570	588	621	663	839	796	764	721	604	479
	3	484	484	449	457	502	545	528	590	678	669	651	563
		572	616	633	633	633	669	880	845	836	757	581	520
	4	489	480	480	489	537	623	565	613	671	671	728	595
		584	642	642	699	738	958	929	853	834	767	604	489

TABLE 1.1.3 CHRONOLOGICAL LOAD CURVE (MW) OF CENTER

YEAR	PERIOD	TIME (H) 1	2	3	4	5	6	7	8	9	10	11	12
		13	14	15	16	17	18	19	20	21	22	23	24
1993	1	70	63	61	61	66	75	95	83	92	85	88	90
		74	75	80	84	88	92	136	160	148	121	109	78
	2	68	65	66	66	75	77	81	88	87	88	87	82
		83	83	86	88	92	110	145	137	128	108	92	77
	3	106	104	102	102	109	110	108	112	113	116	118	112
		107	115	114	115	117	129	189	168	154	141	115	106
	4	58	58	58	59	71	83	74	76	79	84	85	73
		71	82	83	83	97	153	156	146	126	106	71	60
1994	1	87	78	76	76	82	93	118	103	114	106	109	112
		92	93	100	104	109	114	169	199	184	151	136	97
	2	85	81	82	82	93	96	101	109	108	109	108	102
		103	103	107	109	114	137	180	170	159	134	114	96
	3	132	129	127	127	136	137	134	139	141	144	147	139
		133	143	142	143	146	160	235	209	192	175	143	132
	4	72	72	72	73	88	103	92	95	98	104	106	91
		88	102	103	103	121	190	194	182	157	132	88	75

Demand at Generation end JICA (Base)

TABLE 1.2.1 ANNUAL LOAD OF NORTH

YEAR	PEAKLOAD (MW)	GR.RATE (%)	MIN.LOAD (MW)	GR.RATE (%)	ENERGY (GWH)	GR.RATE (%)	LOAD FACTOR (%)
1993	1077.0	-	363.0	-	5376.3	-	56.99
1994	1155.6	7.3	389.5	7.3	5768.7	7.3	56.99
1995	1240.0	7.3	417.9	7.3	6189.9	7.3	56.99
1996	1278.0	3.1	456.0	9.1	6599.3	6.6	58.95
1997	1386.6	8.5	494.8	8.5	7160.2	8.5	58.95
1998	1504.5	8.5	536.8	8.5	7768.8	8.5	58.95
1999	1632.4	8.5	582.4	8.5	8429.2	8.5	58.95
2000	1771.1	8.5	632.0	8.5	9145.7	8.5	58.95
2001	1991.0	12.4	710.0	12.4	10279.7	12.4	58.94
2002	2223.9	11.7	793.1	11.7	11482.4	11.7	58.94
2003	2484.1	11.7	885.9	11.7	12825.8	11.7	58.94
2004	2774.8	11.7	989.5	11.7	14326.5	11.7	58.94
2005	3099.4	11.7	1105.3	11.7	16002.7	11.7	58.94
2006	3320.0	7.1	1268.0	14.7	17874.0	11.7	61.46
2007	3668.6	10.5	1401.1	10.5	19750.7	10.5	61.46
2008	4053.8	10.5	1548.3	10.5	21824.6	10.5	61.46
2009	4479.4	10.5	1710.8	10.5	24116.1	10.5	61.46
2010	4949.8	10.5	1890.5	10.5	26648.3	10.5	61.46
2011	5287.0	6.8	2019.0	6.8	28460.3	6.8	61.45
2012	5842.1	10.5	2231.0	10.5	31448.7	10.5	61.45
2013	6455.6	10.5	2465.2	10.5	34750.8	10.5	61.45
AVRG.		9.4		10.1		9.8	

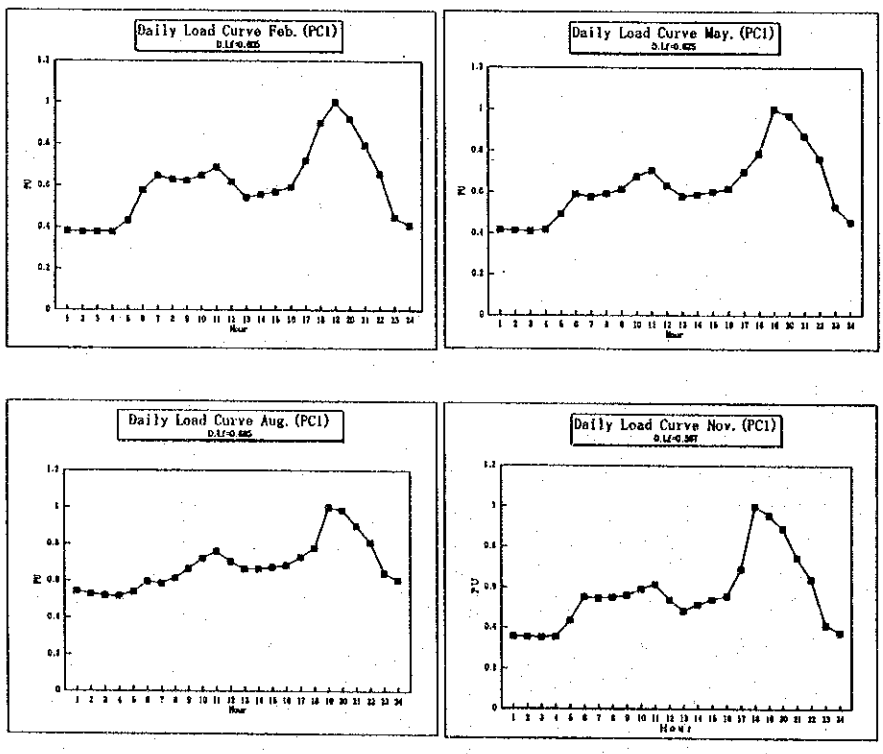


Fig. 8.1-1(a) Daily Load Curve (North)

Demand at Generation end JICA (Base)

TABLE 1.2.2 ANNUAL LOAD OF SOUTH

YEAR	PEAKLOAD (MW)	GR.RATE (%)	MIN.LOAD (MW)	GR.RATE (%)	ENERGY (GWH)	GR.RATE (%)	LOAD FACTOR (%)
1993	817.0	-	350.0	-	4507.2	-	62.98
1994	958.3	17.3	410.5	17.3	5286.9	17.3	62.98
1995	1124.1	17.3	481.6	17.3	6201.6	17.3	62.98
1996	1276.0	13.5	547.0	13.6	7047.5	13.6	63.05
1997	1443.2	13.1	618.7	13.1	7970.7	13.1	63.05
1998	1632.2	13.1	699.7	13.1	9014.9	13.1	63.05
1999	1846.0	13.1	791.4	13.1	10195.9	13.1	63.05
2000	2087.9	13.1	895.0	13.1	11531.5	13.1	63.05
2001	2358.0	12.9	1009.0	12.7	12997.4	12.7	62.92
2002	2645.7	12.2	1132.1	12.2	14583.1	12.2	62.92
2003	2968.4	12.2	1270.2	12.2	16362.2	12.2	62.92
2004	3330.6	12.2	1425.2	12.2	18358.4	12.2	62.92
2005	3736.9	12.2	1599.1	12.2	20598.1	12.2	62.92
2006	4140.0	10.8	1772.0	10.8	22828.6	10.8	62.95
2007	4549.9	9.9	1947.4	9.9	25088.6	9.9	62.95
2008	5000.3	9.9	2140.2	9.9	27572.4	9.9	62.95
2009	5495.3	9.9	2352.1	9.9	30302.0	9.9	62.95
2010	6039.4	9.9	2585.0	9.9	33301.9	9.9	62.95
2011	6638.0	9.9	2841.0	9.9	36593.6	9.9	62.93
2012	7295.2	9.9	3122.3	9.9	40216.4	9.9	62.93
2013	8017.4	9.9	3431.4	9.9	44197.8	9.9	62.93
AVRG.		12.1		12.1		12.1	

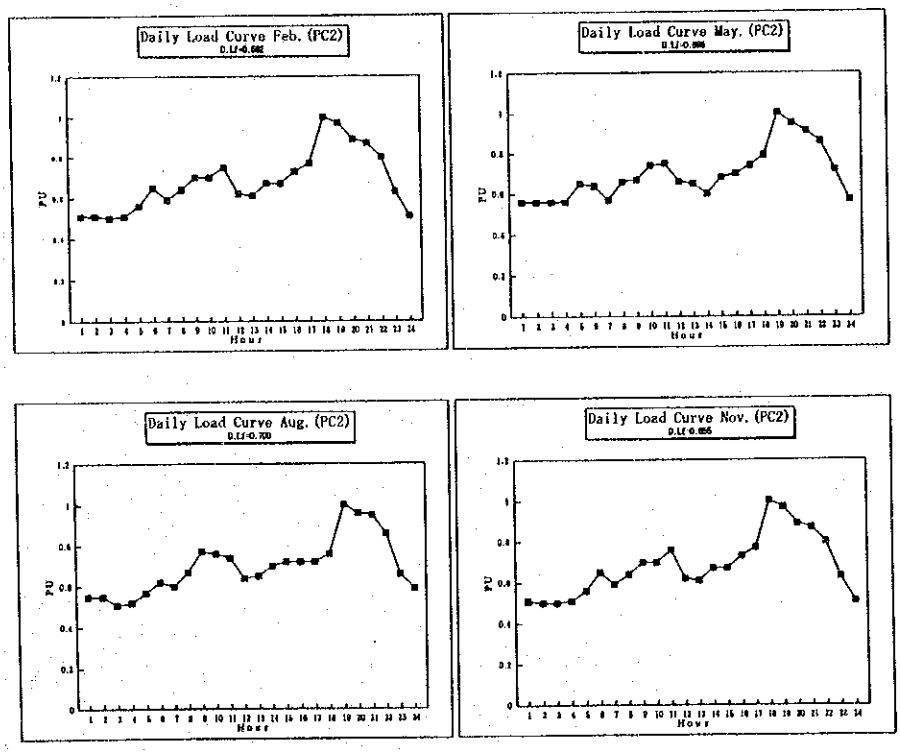


Fig.8.1-1(b) Daily Load Curve (South)

Demand at Generation end JICA (Base)

TABLE 1.2.3 ANNUAL LOAD OF CENTER

YEAR	PEAKLOAD (MW)	GR.RATE (%)	MIN.LOAD (MW)	GR.RATE (%)	ENERGY (GWH)	GR.RATE (%)	LOAD FACTOR (%)
1993	189.0	-	58.0	-	849.3	-	51.30
1994	235.1	24.4	72.2	24.4	1056.5	24.4	51.30
1995	292.5	24.4	89.8	24.4	1314.3	24.4	51.30
1996	336.0	14.9	104.0	15.9	1528.8	16.3	51.94
1997	384.7	14.5	119.1	14.5	1750.5	14.5	51.94
1998	440.5	14.5	136.3	14.5	2004.3	14.5	51.94
1999	504.4	14.5	156.1	14.5	2294.9	14.5	51.94
2000	577.5	14.5	178.8	14.5	2627.7	14.5	51.94
2001	616.0	6.7	202.0	13.0	2890.4	10.0	53.56
2002	679.4	10.3	222.8	10.3	3188.1	10.3	53.56
2003	749.4	10.3	245.8	10.3	3516.5	10.3	53.56
2004	826.6	10.3	271.1	10.3	3878.7	10.3	53.56
2005	911.8	10.3	299.0	10.3	4278.2	10.3	53.56
2006	1027.0	12.6	336.0	12.4	4830.0	12.9	53.69
2007	1122.5	9.3	367.2	9.3	5279.2	9.3	53.69
2008	1226.9	9.3	401.4	9.3	5770.2	9.3	53.69
2009	1341.0	9.3	438.7	9.3	6306.8	9.3	53.69
2010	1465.7	9.3	479.5	9.3	6893.4	9.3	53.69
2011	1611.0	9.9	527.0	9.9	7575.9	9.9	53.68
2012	1760.8	9.3	576.0	9.3	8280.5	9.3	53.68
2013	1924.6	9.3	629.6	9.3	9050.6	9.3	53.68
AVRG.		12.3		12.7		12.6	

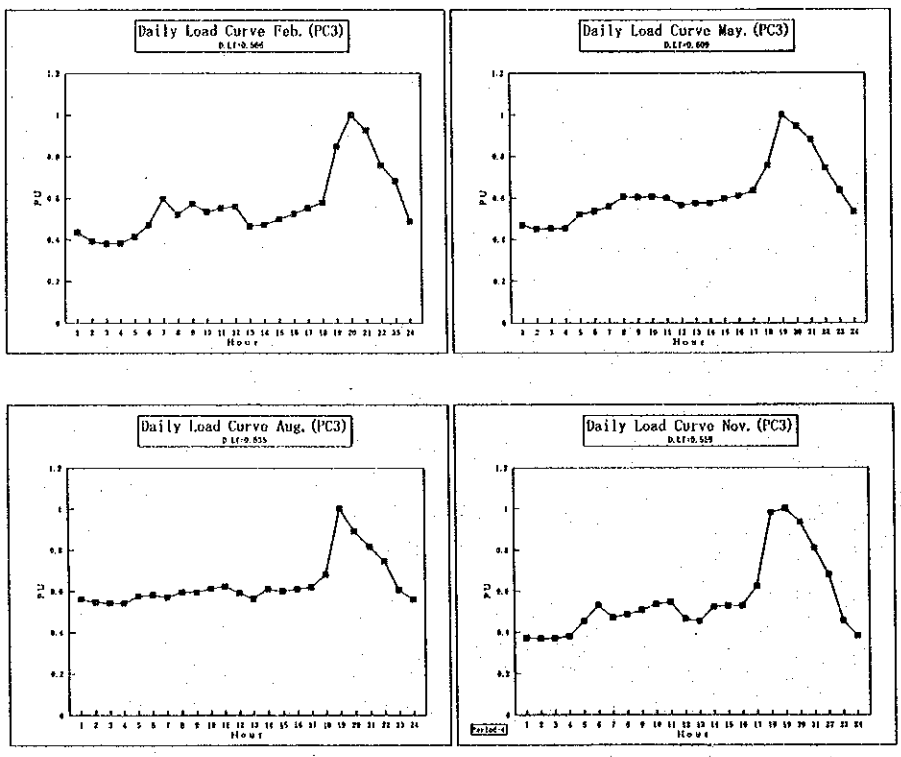


Fig. 8.1-1(c) Daily Load Curve (Central)

VIETNAM THERMAL POWER PLANT DATA (1/2)

INPUT DATA for ESPRIT (JICA)

Item \ Plant Type	COAL Fired P. PLANT				South	
	Northern Coal (yr1995)	Northern Coal (yr2000)	Northern Coal (yr2005)	Northern Coal (yr2010)	Southern Coal (yr2005)	Southern Coal (yr2010)
Plant size	300MW×2					
Construction Cost (US$)	750×10⁶					
⑦Unit Cost (Cost/kw)	$1,250/kw(FC=$1000/kw,LC=$250/kw)					
Plant Life(n)	25yr (Pf=70%)					
Station Service	6.0%					
Maintenance	40days					
FOR	8.0%					
Ave. Efficency	34.0%					
⑤Heat Rate	2529Kcal/kWh	2529Kcal/kWh	2529Kcal/kWh	2529Kcal/kWh	2529Kcal/kWh	2529Kcal/kWh
④Fuel Price	$25/ton	$28/ton	$32/ton	$35/ton	$42/ton	$45/ton
⑧Fixed O&M cost	4.8%	4.8%	4.8%	4.8%		
CRF $\frac{\gamma(1+\gamma)^n}{(1+\gamma)^n-1}$ at $\gamma=10\%$	0.11017	0.11017	0.11017	0.11017		
⑥Caloric Unit	5500Kcal/kg	5500Kcal/kg	5500Kcal/kg	5500Kcal/kg	5500Kcal/kg	5500Kcal/kg
Annual Cost						
① for construction cost	$137.7/Kw(=⑦×CRF)					
② for O&M	$60.0/Kw(=⑦×⑧)					
③ Fuel Cost ($/Kwh)	0.01150	0.01287	0.01471	0.01609	0.01931	0.02069
Generation Cost =④×⑤÷⑥ = {(①+②)/6132Hr÷③)×100 ¢ Pf=70%	4.374¢/Kwh (3.224+1.150)	4.511¢/Kwh (3.224+1.287)	4.695¢/Kwh (3.224+1.471)	4.833¢/Kwh (3.224+1.609)	5.155¢/Kwh (3.224+1.931)	5.293¢/Kwh (3.224+2.069
= {(①+②)/7008Hr+③)×100 ¢ Pf=80%	3.971¢/Kwh (2.821+1.150)	4.108¢/Kwh (2.821+1.287)	4.292¢/Kwh (2.821+1.471)	4.430¢/Kwh (2.821+1.609)	4.752¢/Kwh (2.821+1.931)	4.890¢/Kwh (2.821+2.069
Inp. Data to ESPRIT LFUEL ($/10³ Kcal) =④÷⑥	0.004545	0.005091	0.005818	0.006364	0.007636	0.008182

VIETNAM THERMAL POWER PLANT DATA (2/2)

INPUT DATA for ESPRIT (JICA)

Item \ Plant Type	GAS COMBINED CYCLE (South)			
	$2.0 million BTU('95~2000)	$2.5 million BTU (yr2005)	$3.0 million BTU (yr2010)	$3.5 million BTU (yr2013)
Plant size	300MW×2			
Construction Cost (US$)	480×10^6			
⑦Unit Cost (Cost/kw)	$800/Kw (FC=640, LC=160)			
Plant Life(n)	20yr (Pf=70%)			
Station Service	1.5%			
Maintenance	35days			
FOR	6.0			
Ave. Efficency	45.0%			
⑤Heat Rate	1911Kcal/Kwh			
④Fuel Price	$71.43/$10^3 m^3$	$89.29/$10^3 m^3$	$107.14/$10^3 m^3$	$125.0/$10^3 m^3$
⑧Fixed O&M cost	4.8%			
CRF $\frac{r(1+r)^n}{(1+r)^n-1}$ at $r=10\%$	0.11746			
⑥Caloric Unit	9000Kcal/m^3			
Annual Cost				
① for construction cost	$110.5/Kw (=⑦×CRF /0.85) Output decrease 15% by temperature rise			
② for O&M	$45.2/Kw (=⑦×⑧/0.85)			
③ Fuel Cost ($/Kwh) =④×⑤÷⑥	0.01517	0.01896	0.02275	0.02654
Generation Cost = { (①+②) /6132Hr+③) ×100 ¢ Pf=70%	4.056¢/Kwh (=2.539+1.517)	4.435¢/Kwh (=2.539+1.896)	4.814¢/Kwh (=2.539+2.275)	5.193¢/Kwh (=2.539+2.654)
Generation Cost = { (①+②) /7008Hr+③) ×100 ¢ Pf=80%	3.739¢/Kwh (=2.222+1.517)	4.118¢/Kwh (=2.222+1.896)	4.497¢/Kwh (=2.222+2.275)	4.876¢/Kwh (=2.222+2.654)
Inp. Data for ESPRIT LFUEL ($/$10^3$ Kcal) =④÷⑥	0.007937 1BTU=0.252Kcal	0.009921	0.011905	0.013889

Vietnam Hydro Plant Data (1/2) Average Year(P=50%)

INPUT DATA for ESPRIT
JICA (EPDC)

Plant Name (North)	Installed Cap. ×No. Unit	Commissioning Yr.	Annual gene. Energy	Seasonal Generation (GWh) Quarter 1st	2nd	3rd	4th	Power Output (MW) Peak/ Firm Quarter 1st	2nd	3rd	4th	Annual Coost ($/KW) Local ($/KW) 40%	Foregin ($/KW) 60%	Tot.Constr. Cost ×10⁶ $ At the level'93	
<Existing> Thac Ba	3×36MW	#1 '70 #2 '71 #3 '73	439GWh	95	83	145	116	108/ 0	90/ 0	108/0	108/0	Existing	——	——	
Hoa Binh	8×240MW	#1 '88 #2 '89 #3,4 '91 #5,6,7 '93 #8,'94	8797 (8units) ⇩ 11,113 with Large Son La 9,659 with Small Son La	Independent Operation 1649	1650	3300 Max:2700	2198	1900/360	1250/280	1250/623	1920/563	Existing	——	——	
			These incremental energys are added to Son La after 3rd. unit												
<Planning> Son La 1,2 (Large)	2×300MW	2007~	2513	497	587	677	752	600/134	583/122	600/208	600/140	1580 (40%)	2370 (60%)	2370 (68%)	
3,4	2×300	2008~	2976	641	741	842	752	600/134	583/122	600/208	600/140	74 (20%)	297 (80%)	223 (6.4%)	Cost of transmis-sion line is excluded
5,6	2×300	2009~	2976	641	741	842	752	600/134	583/122	600/208	600/140	74 (20%)	297 (80%)	223 (6.4%)	
7,8	2×300	2010~	2976	641	741	842	752	600/134	583/122	600/208	600/140	74 (20%)	297 (80%)	223 (6.4%)	
9,10	2×300	2011~	2976	641	741	842	752	600/134	583/122	600/208	600/140	74 (20%)	297 (80%)	223 (6.4%)	
11,12	2×300	2012~	2976	641	741	842	752	600/134	583/122	600/208	600/140	74 (20%)	297 (80%)	223 (6.4%)	
		total	17393	3702	4292	4887	4512							Tot.3485 (100%)	
Son La 1,2 (Small)	2×240MW	2007~	1988	410	451	574	553	480/ 95	380/102	480/200	480/130	1162 (40%)	1742 (60%)	1394 (68%)	
3,4	2×240	2008~	2204	422	453	752	577	480/ 95	380/102	480/200	480/130	68 (20%)	273 (80%)	164 (8%)	Cost of transmis-sion line is excluded
5,6	2×240	2009~	2204	422	453	752	577	480/ 95	380/102	480/200	480/130	68 (20%)	273 (80%)	164 (8%)	
7,8	2×240	2010~	2204	422	453	752	577	480/ 95	380/102	480/200	480/130	68 (20%)	273 (80%)	164 (8%)	
9,10	2×240	2011~	2204	422	453	752	570	480/ 95	380/102	480/200	480/130	68 (20%)	273 (80%)	164 (8%)	
		total	10804	2098	2263	3582	2841							Tot.2050 (100%)	
Ban Mai	350MW	2002~	1777	440	413	440	484	350/88	350/83	350/85	350/93	434(40%)	651(60%)	380 (100%)	
Cua Dat	105	2003~	507	130	100	110	167	105/28	100/20	102/21	105/32	739(40%)	1108(60%)	194 (100%)	
Dai Thi	250	2002~	1308	246	320	463	279	233/60	187/74	250/107	250/65	481(40%)	722(60%)	301 (100%)	
Huoi Quan #1,2	2×200MW	2012~	1492*	296	300	496	400	400/100	400/100	400/100	400/100	515(40%)	772(60%)	515 (70%)	
			Includes discharge to downstream (SonLa+HoaBinh)												
#3,4	2×200MW	2013~	1492*	296	300	496	400	400/100	400/100	400/100	400/100	110(20%)	440(80%)	220 (30%)	

(Source) Hydro condition : JICA Jan. 1995
Construction Cost:PIDC-1 Sep. 1994

Data correction history '94-8-24 Created
'95-3-29 Energy Updated
'95-4-7 Huoi Quan added

Vietnam Hydro Plant Data (2/2) Average Year(P=50%)

INPUT DATA for ESPRIT
JICA (EPDC)

Plant Name (South & Cent)	Installed Cap. ×No. Unit	Commissioning Yr.	Annual Generat. Energy	Seasonal Generation (GWh) Quarter 1st	2nd	3rd	4th	Power Output (MW) Peak/ Firm Quarter 1st	2nd	3rd	4th	Annual Cost ($/KW) Local ($/KW) 40%	Foregin ($/KW) 60%	Tot.Constr. Cost ×10⁶ $ At the level'93	Comment
<Existing> South			(GWh)												
Da Nhim	4×40MW		1159	289	257	288	325	160/ 0	160/ 0	160/ 0	160/ 0	Existing	Existing	——	
Tri An	4×100		1883	303	298	680	602	400/40	370/45	365/45	400/43	Existing	Existing	——	
Thac Mo	2×75	1994	589.5	103	99	234.9	152.6	150/0	150/0	150/0	150/0	288(30%)	672(70%)	144	
<Planning>															
Ham Thuan	2×150MW	2000	972	164	175	360	273	300/0	300/0	300/0	300/0	417 (35%)	776 (65%)	358	
Da Mi	2×86MW	2000	951	91	94	225	141	172/0	172/0	172/0	172/0	380 (35%)	707 (65%)	187	
Dai Ninh	300	2003 ~	1218	248	254	353	363	300/0	300/0	300/0	300/0	499 (40%)	748 (60%)	374*	*M534 Benefit by irrigati -on
Dong Nai4	200	2006 ~	950	123	123	336	368	199/0	175/0	187/0	200/0	500 (40%)	750 (60%)	250	
Dong Nai8	192	2003 ~	953	123	126	336	368					985 (40%)	1478 (60%)	473	
Can Don	50	.....	200	40	40	60	60					936 (40%)	1404 (60%)	117	
<Existing> Central															
Dray H'linh	12MW														
An Diem	5MW														
<Planning>															
Yaly #1,2	2×180MW	1999	1790	370	400	470	550	360/ 0	300/ 0	341/ 0	360/ 0	400 (40%)	600 (60%)	360 (70%)	
#3,4	2×180	2000	1790	370	400	470	550	360/ 0	300/ 0	341/ 0	360/ 0	83 (20%)	333 (80%)	150 (30%)	
Plei Krong	120MW	2001 ~	785* (*with Yaly)	185	200	200	200	120/ 0	120/ 0	120/ 0	120/ 0	833 (40%)	1250 (60%)	250	
Ving Sonh(Vinh Son)	2×33MW	1995	228.6	55.1	56.1	56.6	60.8	66/ 0	66/ 0	66/ 0	66/ 0	412 (40%)	618 (60%)	68	
Song Hinh	2×35MW	1998	294	63	55	54	122	70/ 0	70/ 0	70/ 0	70/ 0	666 (40%)	1000 (60%)	110	
Se San #3	220	2002 ~	1079	213	218	276	372	220/45	220/46	220/58	220/78	342 (40%)	513 (60%)	188	
Se San #4	366	2006 ~	1810	328	394	495	593	360/69	360/83	360/105	360/125	562 (40%)	842 (60%)	514	
Son Con2	60	2005 ~	271	67	67	67	70	60/ 0	60/ 0	60/ 0	60/ 0	667 (40%)	1000 (60%)	100	
An Khe	116	2004 ~	480	120	120	120	120	116/27	116/27	116/27	116/27	593 (40%)	890 (60%)	172	
Pao Quan	80	2007 ~	280	70	70	70	70	80/ 0	80/ 0	80/ 0	81/ 0	695 (40%)	1042 (60%)	139	
Buon Cuop	81	2002 ~	470	120	110	120	120	81/ 0	81/ 0	81/ 0	81/ 0	568 (40%)	851 (60%)	115	
Thuong Kon Tum	260MW	2004 ~	735**	150	164	195	226	260/47	260/50	260/55	260/70	425 (40%)	637 (60%)	276	

** Discharge is changed to another catchment area.

Vietnam Hydro Plant Data, Dry year (P=90%)

INPUT DATA for ESPRIT
JICA (EPDC)

Plant Name (North)	Installed Cap. ×No. Unit	Commissioning Yr.	Annual gene. Energy	Seasonal Generation (GWh) Quarter 1st	2nd	3rd	4th	Power Output (MW) Peak/ Firm Quarter 1st	2nd	3rd	4th	Annual Coost ($/KW) Local ($/KW) 40%	Foregin ($/KW) 60%	Tot.Constr. Cost ×10⁶ $ At the level'93	Comment
<Existing> Thac Ba	3×36	#1 '70 #2 '71 #3 '73													
				W/O Son La											
Hoa Binh	8×240MW	#1 '88 #2 '89 #3,4 '91 #5,6,7 '93 #8,'94	6374 (8units) ⇩ 8,209 with Son La large 7,070 with Son La small	1155	1500	2307	1412	1900/270	1100/297	1100/297	1900/282	Existing	Existing	——	
				These incremental energys are added to Son La after 3rd. unit											
<Planning> Son La 1,2 (large)	2×300	2007~	1990	470	445	565	510	573/110	467/ 90	600/220	600/120	1580 (40%)	2370 (60%)	2570 (68%)	
3,4	2×300	2008~	2557	570	540	660	587	573/110	467/ 90	600/220	600/120	74 (20%)	297 (80%)	223 (6.4%)	
5,6	2×300	2009~	2357	570	540	660	587	573/110	467/ 90	600/220	600/120	74 (20%)	297 (80%)	223 (6.4%)	Cost of transsmi-ssion line is excluded
7,8	2×300	2010~	2357	570	540	660	587	573/110	467/ 90	600/220	600/120	74 (20%)	297 (80%)	223 (6.4%)	
9,10	2×300	2011~	2357	570	540	660	587	573/110	467/ 90	600/220	600/120	74 (20%)	297 (80%)	223 (6.4%)	
11,12	2×300	2012~	2357	570	540	660	587	573/110	467/ 90	600/220	600/120	74 (20%)	297 (80%)	223 (6.4%)	
		total	13775	3320	3145	3865	3445							Tot.3485 (100%)	
Son La 1,2 (Small)	2×240	2007~	1606	270	370	500	466	480/65	380/ 60	480/200	480/ 65	1162 (40%)	1742 (60%)	1394 (68%)	
3,4	2×240	2008~	1780	330	430	590	430	480/65	380/ 60	480/200	480/ 65	68 (20%)	273 (80%)	164 (8%)	Cost of transsmi-ssion line is excluded
5,6	2×240	2009~	1780	330	430	590	430	480/65	380/ 60	480/200	480/ 65	68 (20%)	273 (80%)	164 (8%)	
7,8	2×240	2010~	1780	330	430	590	430	480/65	380/ 60	480/200	480/ 65	68 (20%)	273 (80%)	164 (8%)	
9,10	2×240	2011~	1780	330	430	590	430	480/65	380/ 60	480/200	480/ 65	68 (20%)	273 (80%)	164 (8%)	
		total	8725	1590	2090	2860	2186							Tot.2050 (100%)	
Ban Mai	350MW	2002~	1165	284	272	305	304	290/ 0	240/ 0	323/ 0	350/ 0	434(40%)	651(60%)	380 (100%)	
Qua Dat	105	2003~	330	60	60	100	110	105/ 0	100/ 0	102/ 0	105/ 0	739(40%)	1108(60%)	194 (100%)	
Dai Thi	250	2002~	950	200	200	300	250	233/ 0	187/ 0	250/ 0	250/ 0	481(40%)	722(60%)	301 (100%)	
Huoi Quang #1,2	2×200MW	2012~	1360	240	450	340	330	380/0	390/0	400/0	400/0	515(40%)	772(60%)	515 (70%)	
				Discharge to the downsteam(Son La & Hoa Binh) is included											
#3,4	2×200	2013~	1360	240	450	340	330	380/0	390/0	400/0	400/0	110(20%)	440(80%)	220 (30%)	

Vietnam Hydro Plant Data, wet year (P=10%)

INPUT DATA for ESPRIT
JICA (EPDC)

Plant Name (North)	Installed Cap. ×No. Unit	Commissioning Yr.	Annual gene. Energy	Seasonal Generation (GWh) Quarter 1st	2nd	3rd	4th	Power Output (MW) Peak/ Firm Quarter 1st	2nd	3rd	4th	Annual Cost ($/KW) Local ($/KW) 40%	Foregin ($/KW) 60%	Tot.Constr. Cost ×10⁶ $ At the level'93	comment
<Existing> Thac Ba	3×36MW	#1 '70 #2 '71 #3 '73	439GWh	95	83	145	116	108/ 0	90/ 0	108/0	108/0	———	———	———	
				Independent operation											
Hoa Binh	8×240MW	#1 '88 #2 '89 #3,4 '91 #5,6,7 '93 #8,'94	9619 (8units) ⇩ 12,401 with Son La large 10,547 with Son La small	1805	1810	3034	2970	1920/300	1317/300	1383/300	1920/300	———	———	———	
				These incremental energys are added to Son La after 3rd. unit											
<Planning> Son La 1,2 (Large)	2×300MW	2007~	3010	524	690	1110	686	600/200	600/200	600/200	600/200	1580 (40%)	2370 (60%)	2370 (68%)	
3,4	2×300	2008~	3568	621	815	1315	817	600/200	600/200	600/200	600/200	74 (20%)	297 (80%)	223 (6.4%)	
5,6	2×300	2009~	3568	621	815	1315	817	600/200	600/200	600/200	600/200	74 (20%)	297 (80%)	223 (6.4%)	Cost of transmis-sion line is excluded
7,8	2×300	2010~	3568	621	815	1315	817	600/200	600/200	600/200	600/200	74 (20%)	297 (80%)	223 (6.4%)	
9,10	2×300	2011~	3568	621	815	1315	817	600/200	600/200	600/200	600/200	74 (20%)	297 (80%)	223 (6.4%)	
11,12	2×300	2012~	3568	621	815	1315	817	600/200	600/200	600/200	600/200	74 (20%)	297 (80%)	223 (6.4%)	
		total	20850	3629	4765	7685	4771							Tot.3485 (100%)	
Son La 1,2 (Small)	2×240MW	2007~	2134	450	490	620	574	480/ 95	380/102	480/200	480/130	1162 (40%)	1742 (60%)	1394 (68%)	
3,4	2×240	2008~	2366	500	560	700	606	480/ 95	380/102	480/200	480/130	68 (20%)	273 (80%)	164 (8%)	
5,6	2×240	2009~	2366	500	560	700	606	480/ 95	380/102	480/200	480/130	68 (20%)	273 (80%)	164 (8%)	
7,8	2×240	2010~	2366	500	560	700	606	480/ 95	380/102	480/200	480/130	68 (20%)	273 (80%)	164 (8%)	
9,10	2×240	2011~	2366	500	560	700	606	480/ 95	380/102	480/200	480/130	68 (20%)	273 (80%)	164 (8%)	
		total	11598	2450	2730	3420	2998							Tot.2050 (100%)	
Ban Mai	350MW	2002~	2027	465	396	599	567	350/ 0	330/ 0	317/ 0	350/ 0	434(40%)	651(60%)	380 (100%)	
Qua Dat	105	2003~	550	152	111	117	170	105/28	100/20	102/21	105/32	739(40%)	1108(60%)	194 (100%)	
Dai Thi	250	2002~	1402	260	340	480	322	233/60	187/74	250/107	250/65	481(40%)	722(60%)	301 (100%)	
Huoi Quang #1,2	2×200MW	2012~	1630	300	500	430	400	400/0	400/0	400/0	400/0	515(40%)	776(60%)	515 (70%)	
				Includes Discharge to the downstream (Son La & Hoa Binh)											
#3,4	2×200MW	2013~	1630		500	430	400	400/0	400/0	400/0	400/0	110(20%)	440(80%)	220 (30%)	

List of Study Cases

(1) Basic Case, Demand:JICA Base

1) With Son La

Case① : SL/GL (Son La Large+Gas Large)

Case② : SL/GS (Son La Large+Gas Small)

Case③ : SS/GL (Son La Small+Gas Large)

Case④ : SS/GS (Son La Small+Gas Small)

2) Without Son La

Case01 : NS/GL (No-Son La+Gas Large)

Case02 : NS/GS (No-Son La+Gas Small)

(2) Optional Case

1) Demand JICA High Case

Case⑤ : SL/GL (Son La Large+Gas Large)

Case⑥ : SL/GS (Son La Large+Gas Small)

Case⑦ : SS/GL (Son La Small+Gas Large)

Case⑧ : SS/GS (Son La Small+Gas Small)

2) Delayed Son La (2 years), Demand: JICA Base

Case⑨ : SL/GS

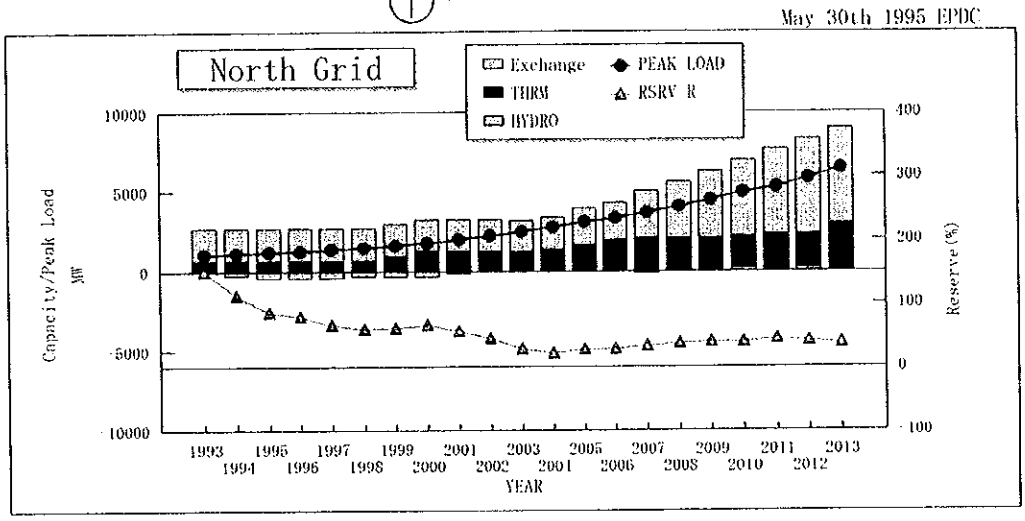
Case⑩ : SS/GS

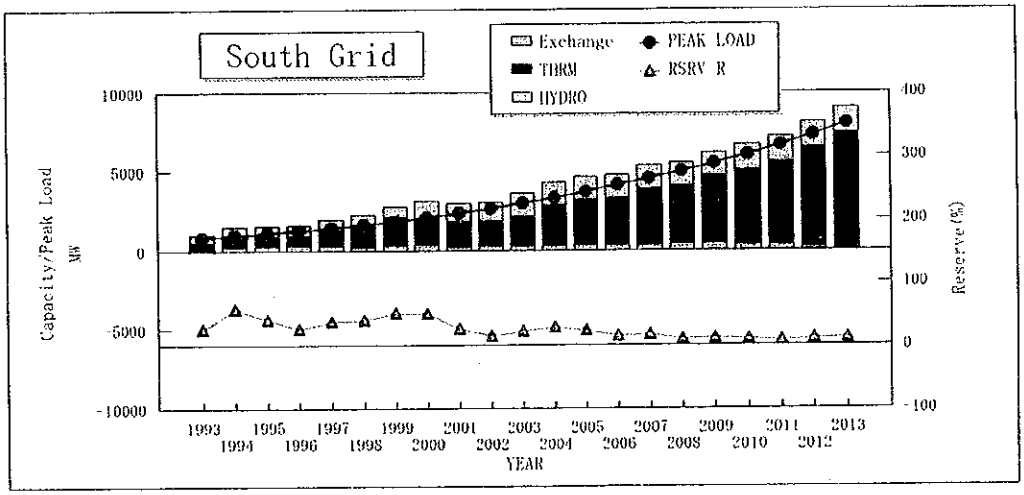
3) Riliability (LOLP=3.0%)

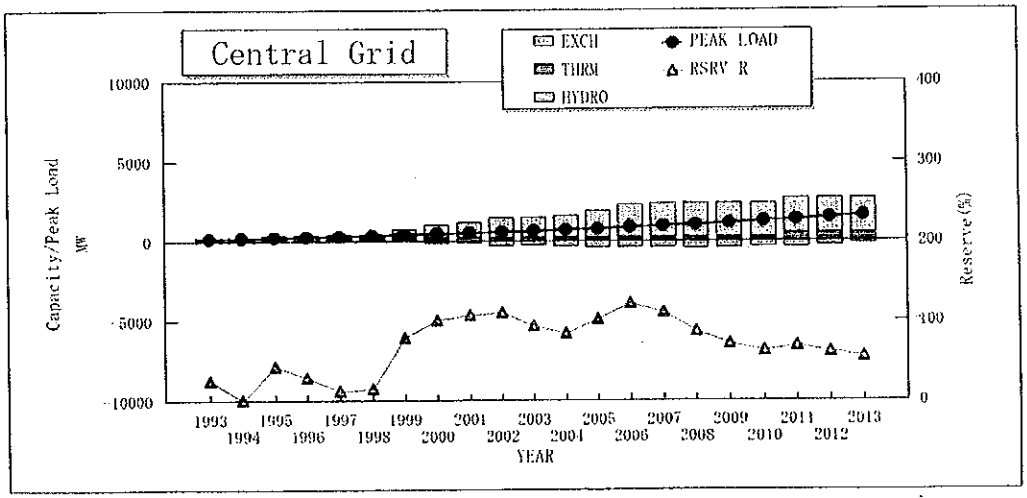
Case⑪ : SS/GS , Demand: JICA Base

Peak Balance of Each Grid

(Case SL/GL)



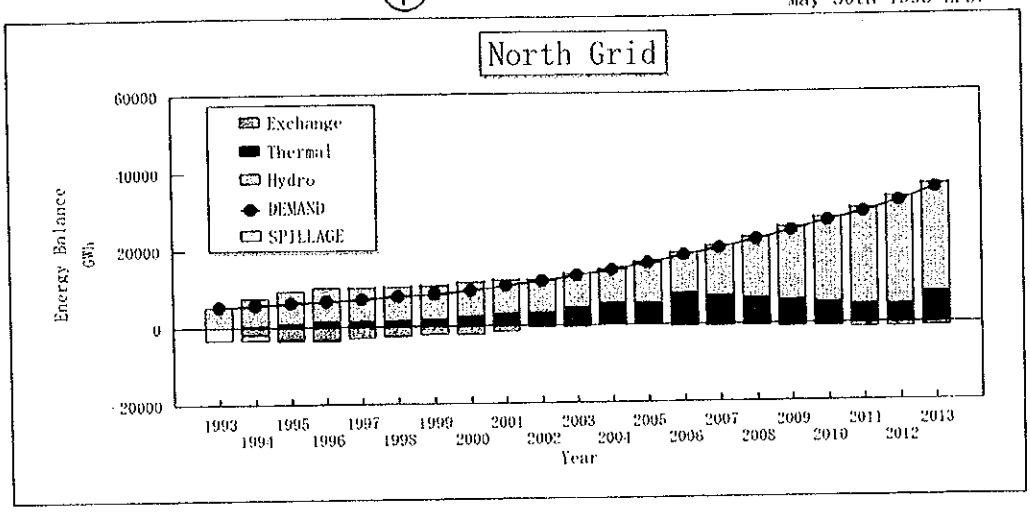


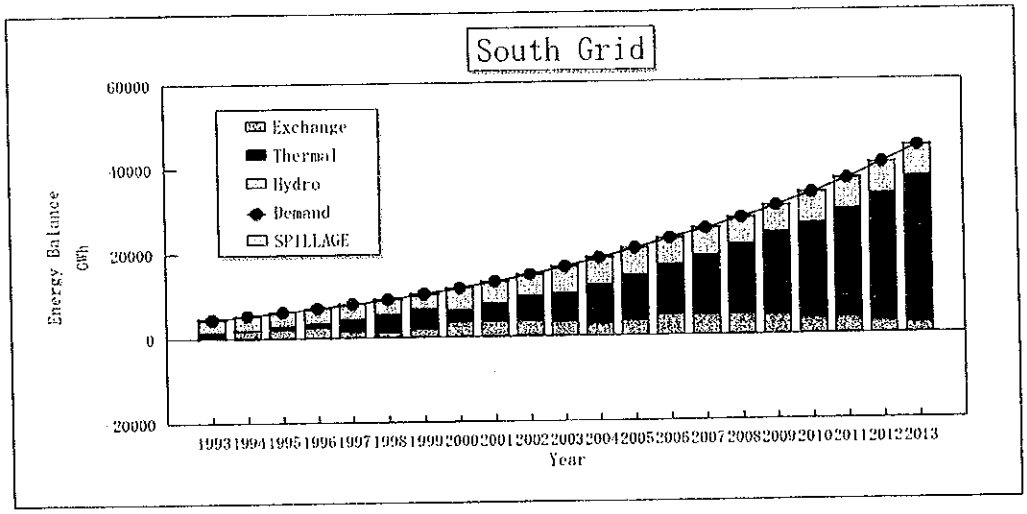


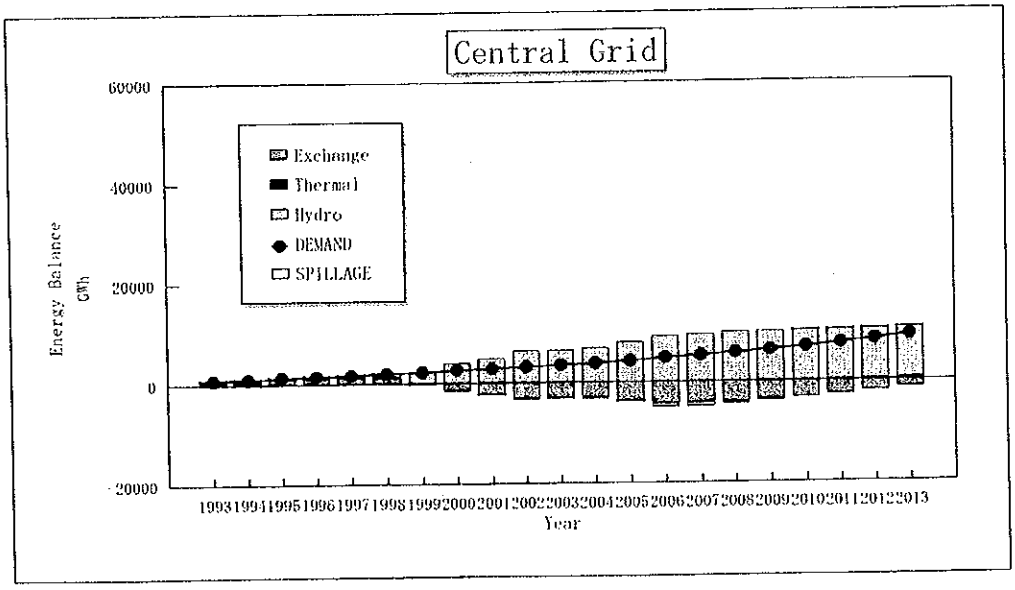
Energy Balance of Each Grid

(1) (Case SL/GL)

May 30th 1995 EPDC

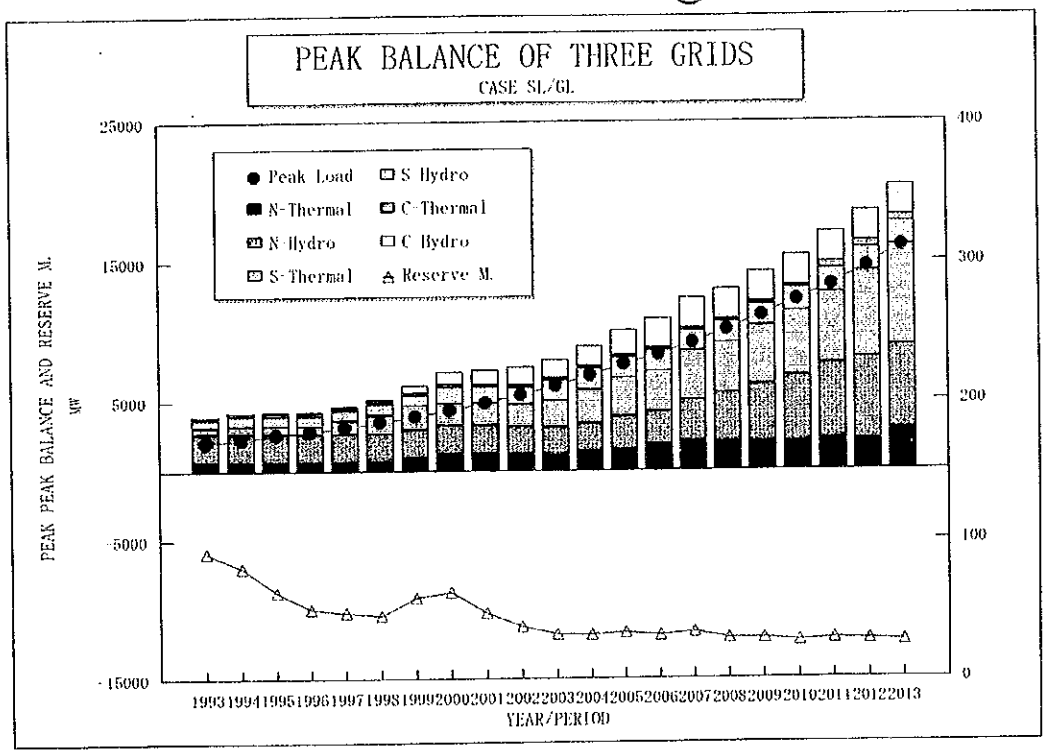






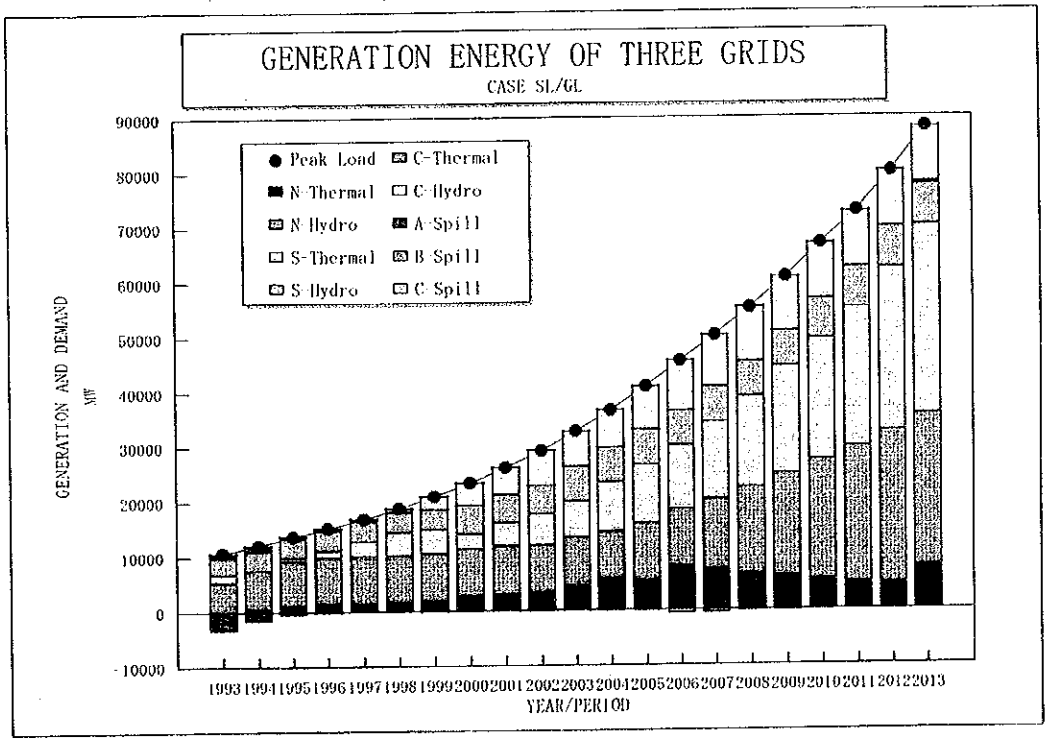
May 30th 1995 EPDC

Peak Balance in all Vietnam (Case-SL/GL) ①



May 30th 1995 EPDC

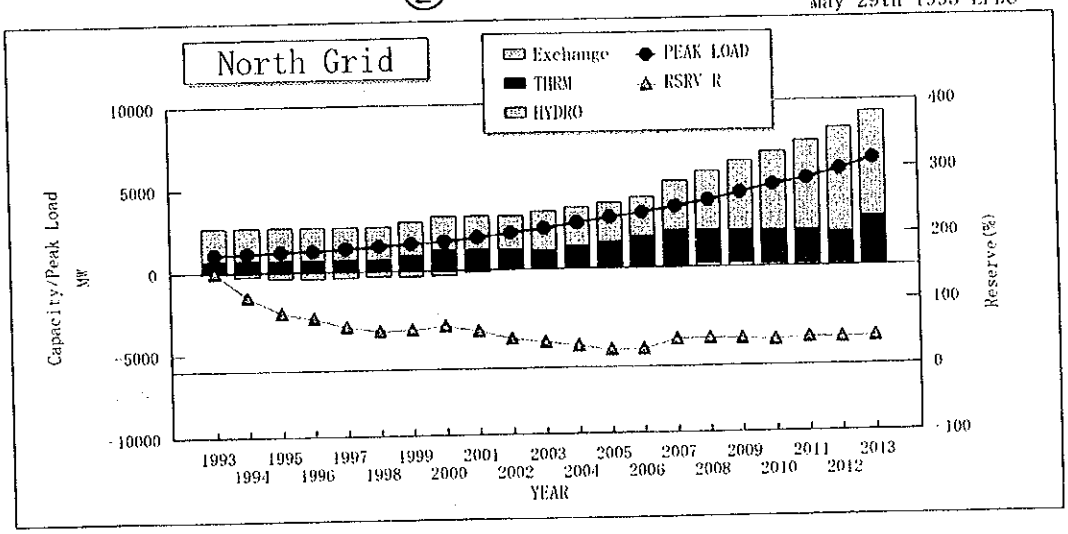
Energy Balance in all Vietnam

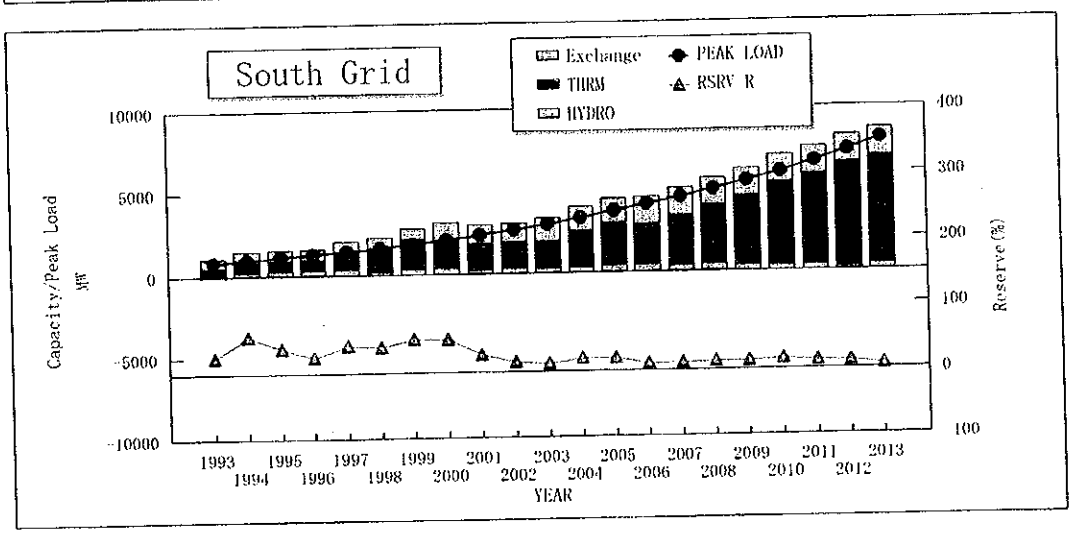


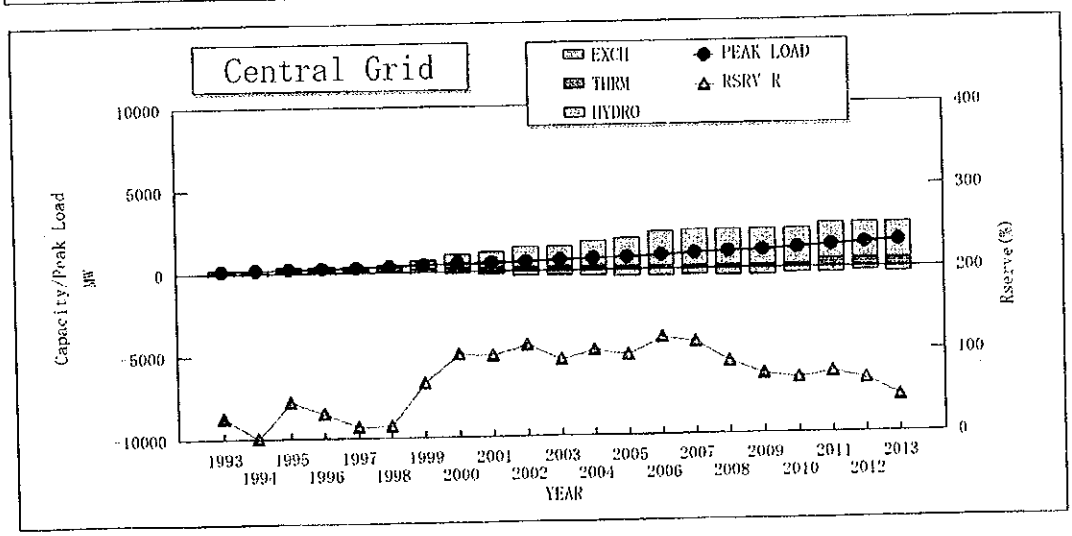
Peak Balance of Each Grid

② (Case SL/GS)

May 29th 1995 EPDC



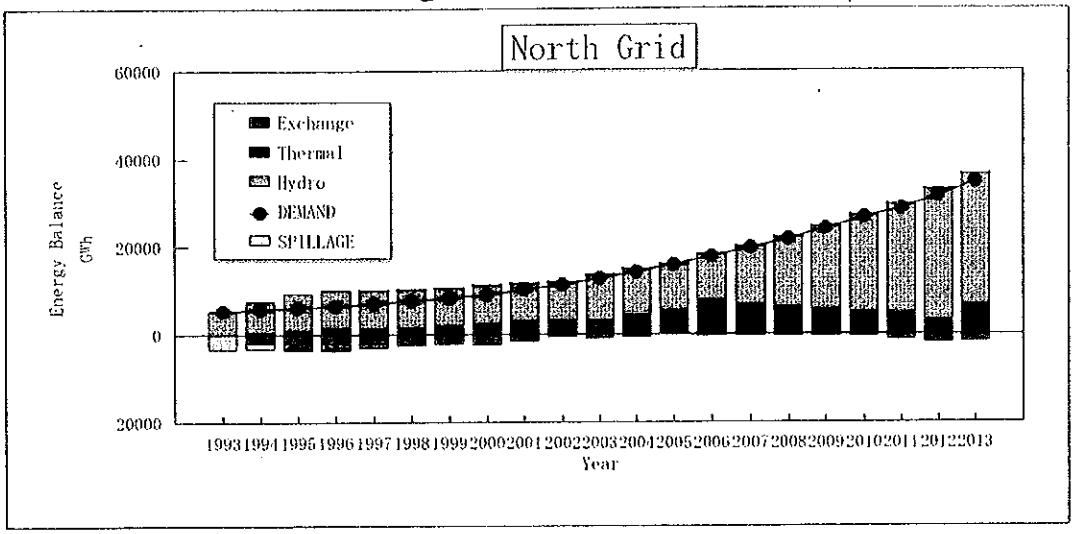


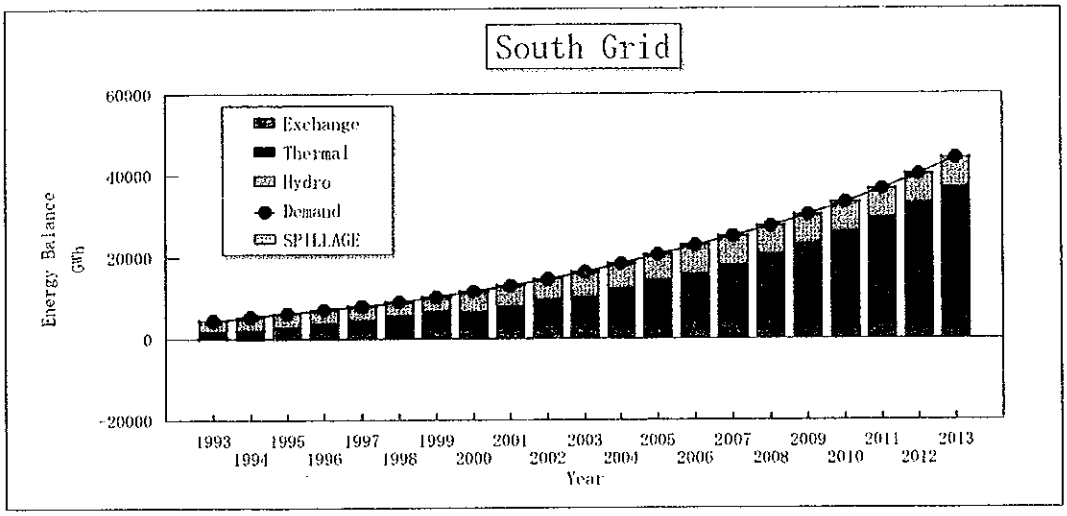


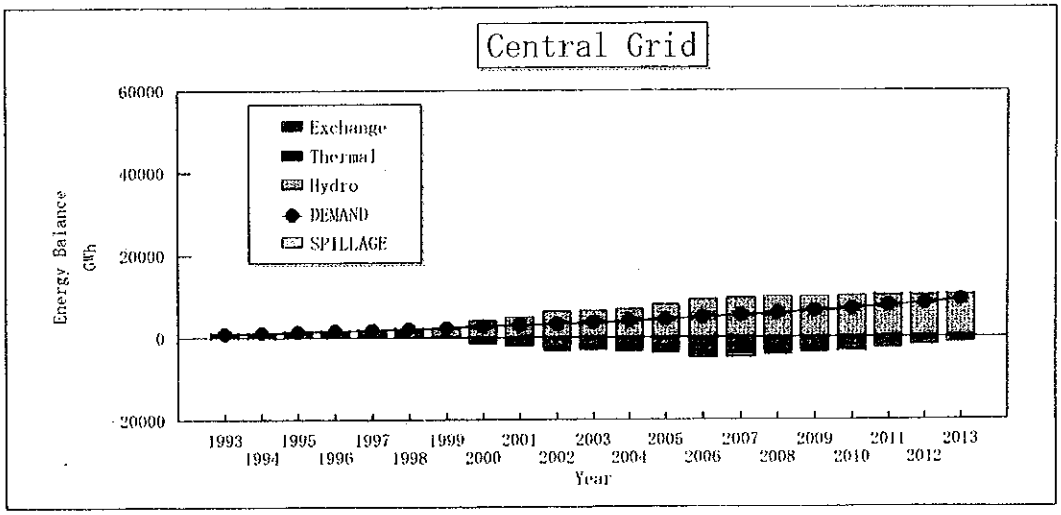
Energy Blance of Each Grid

② (Case SL/GS)

May 29th 1995 EPDC

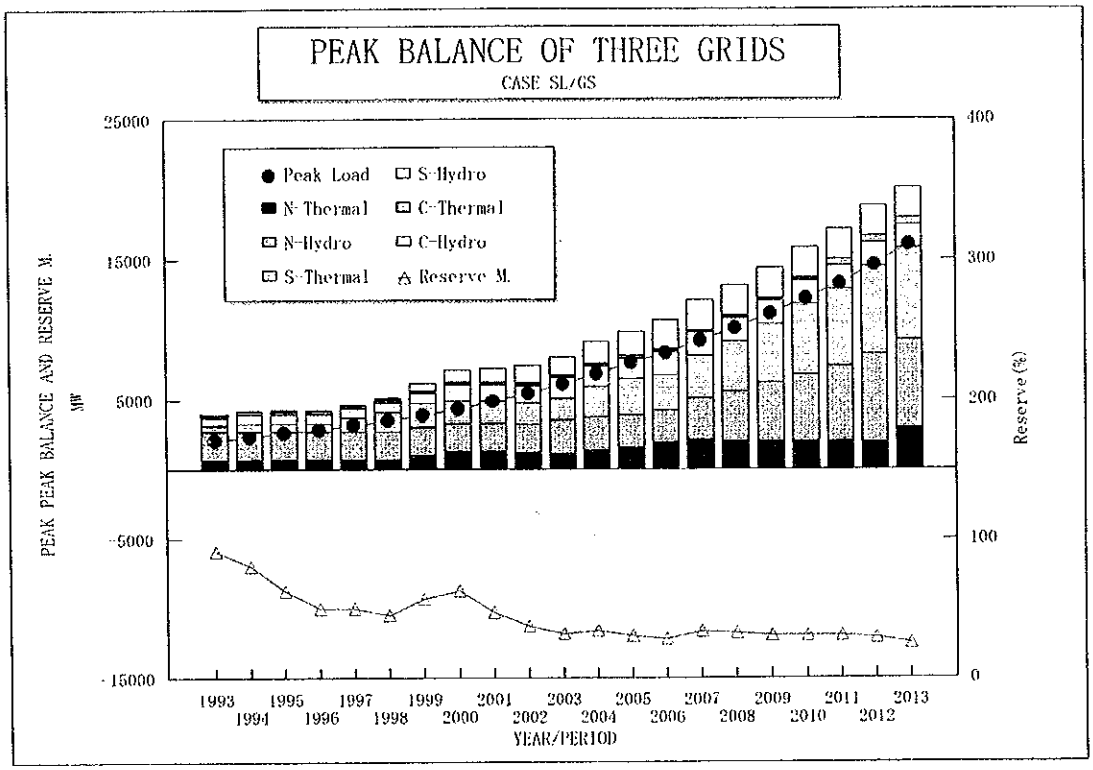






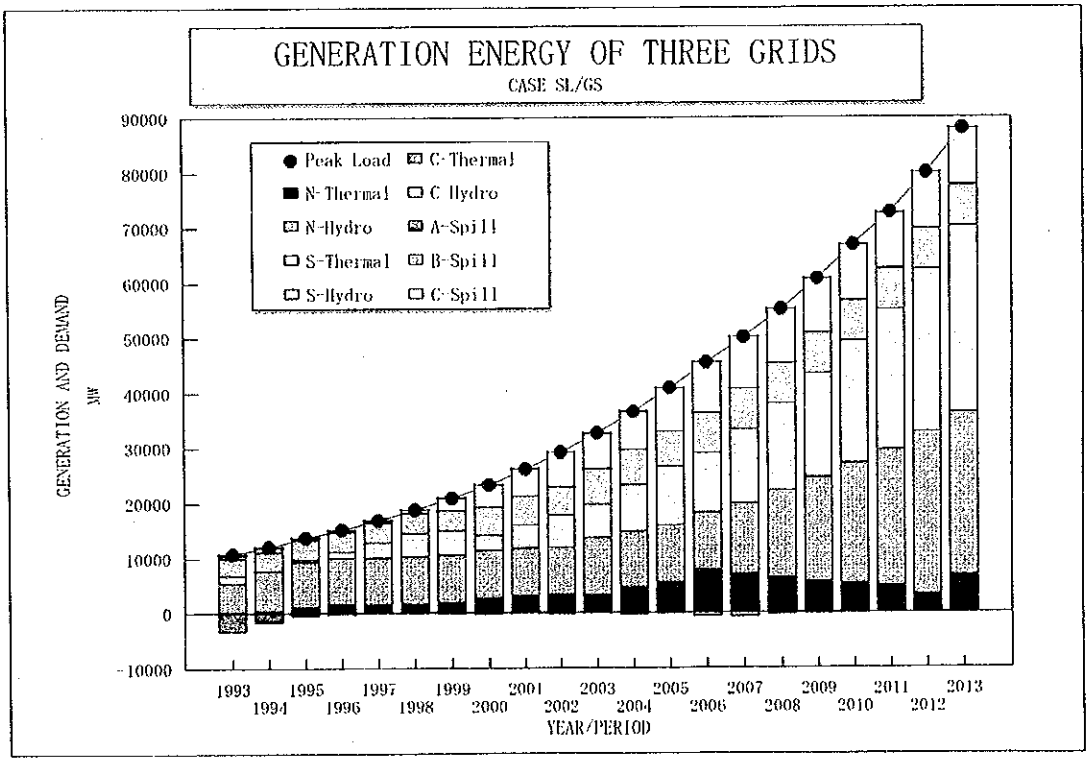
May 29th 1995 EPDC

Peak Balance in all Vietnam (Case-SL/GS) ②

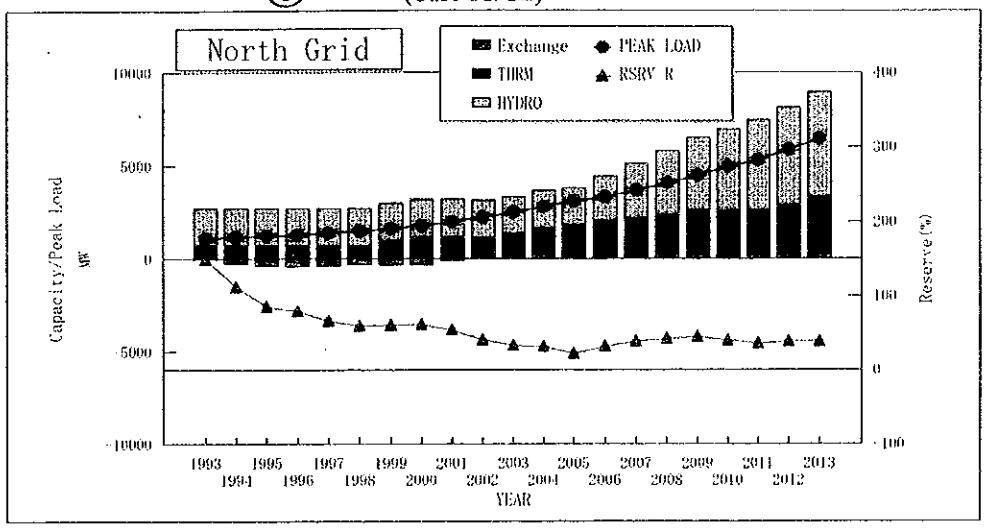


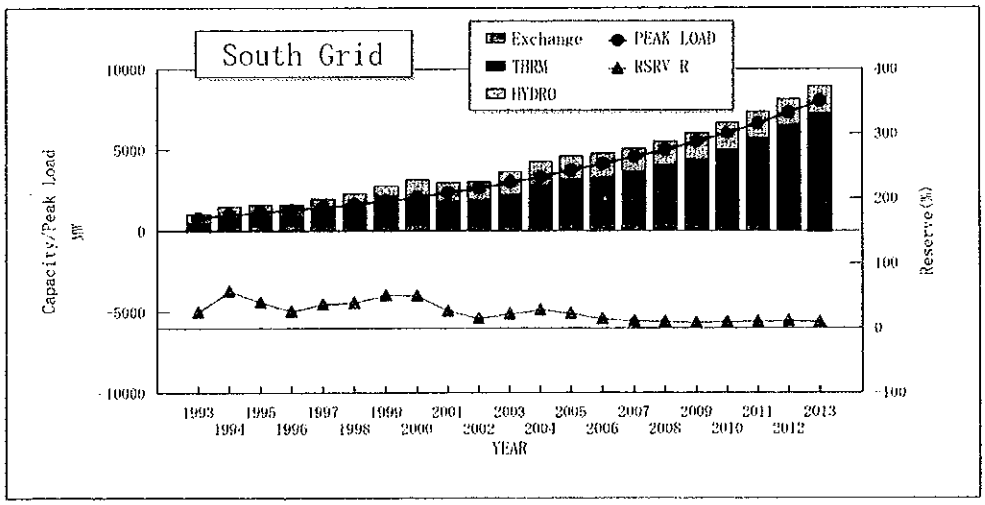
Energy Balance in all Vietnam (SL/GS)

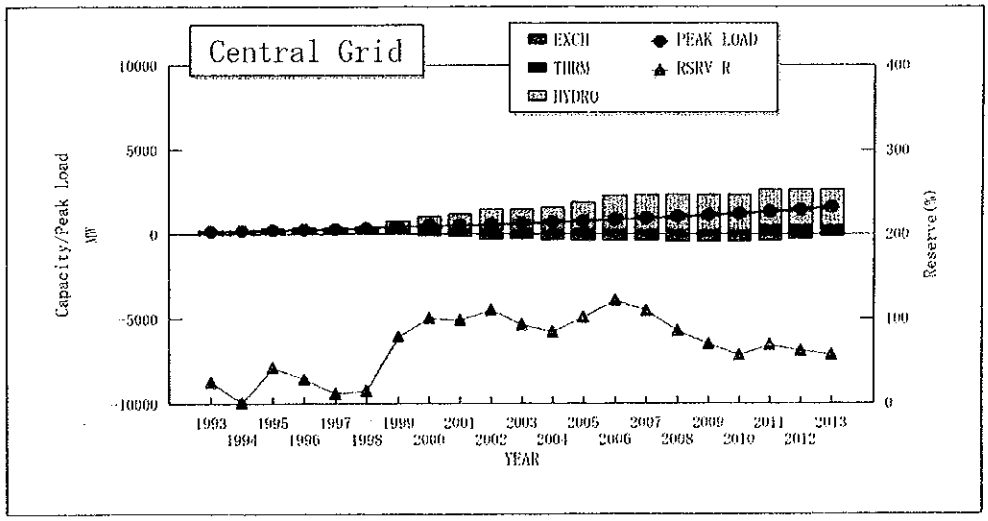
May 29th 1995 EPDC



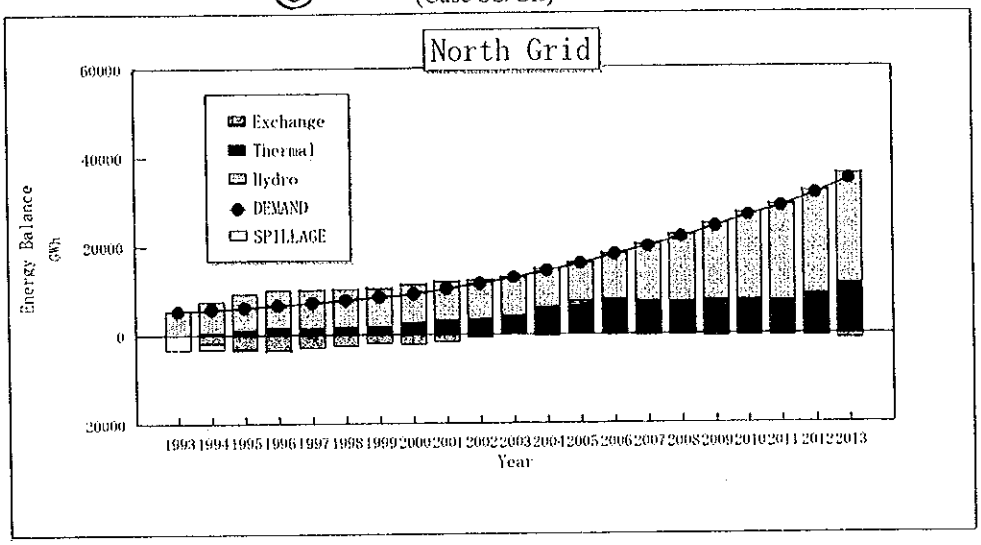
③ Peak Balance of Each Grid
(Case SS/GL)

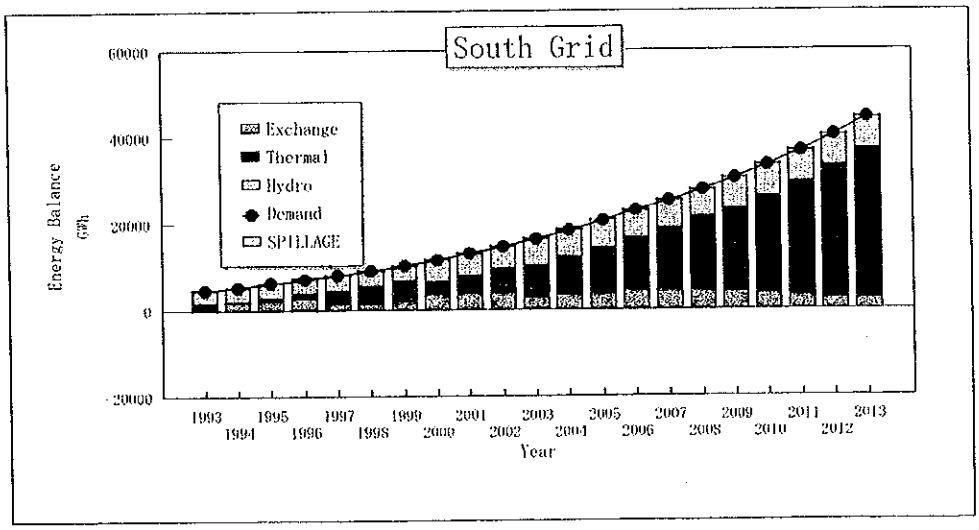


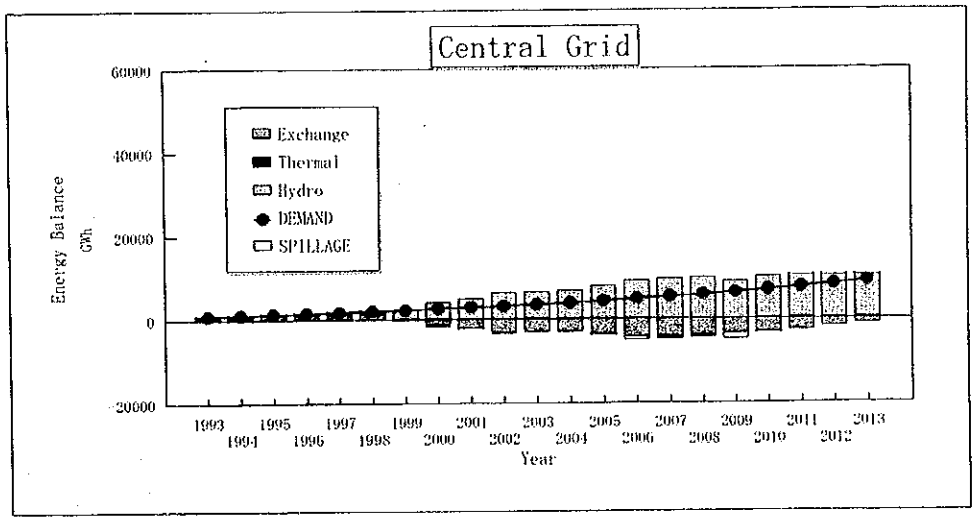




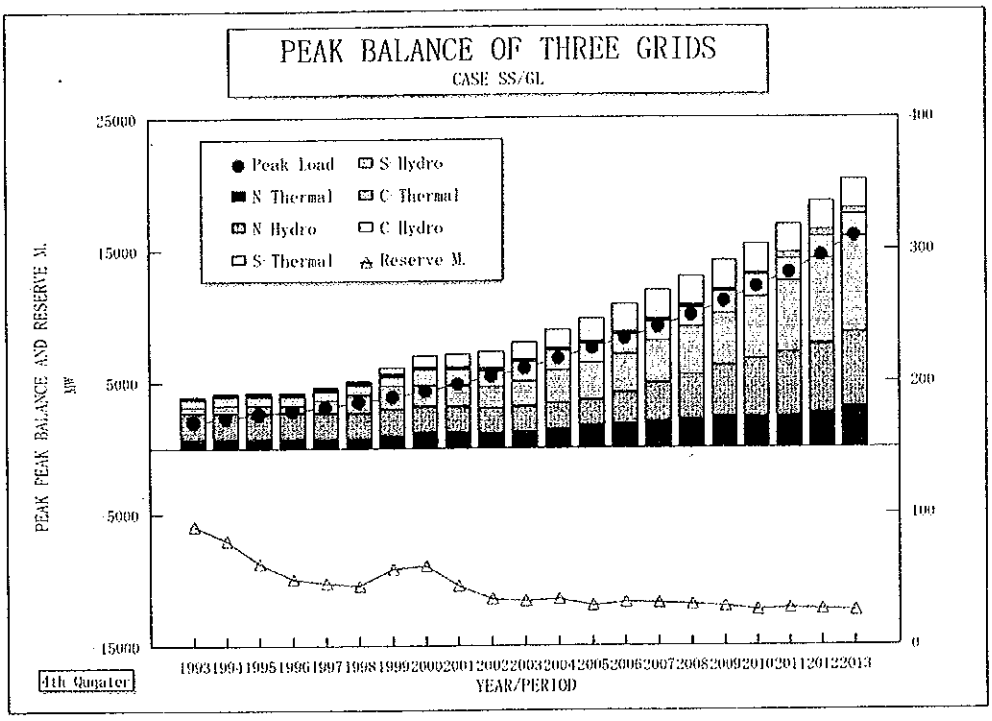
③ Energy Balance of Each Grid
(Case SS/GL)



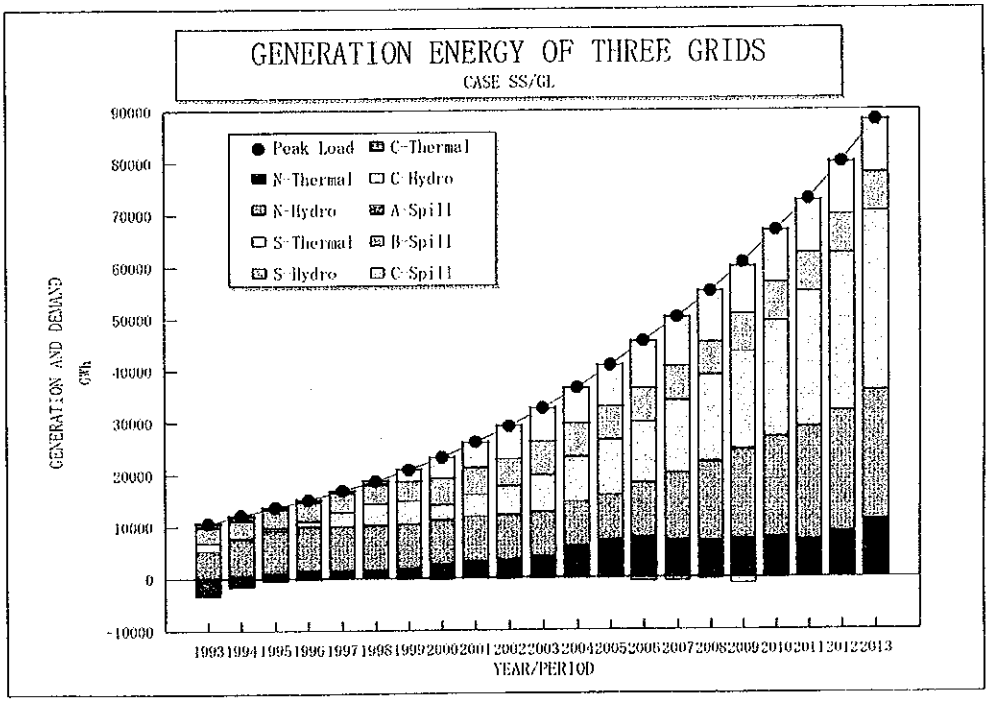




Peak Balance in all Vietnam (Case-SS/GL) ③ May 30th 1995 EPDC

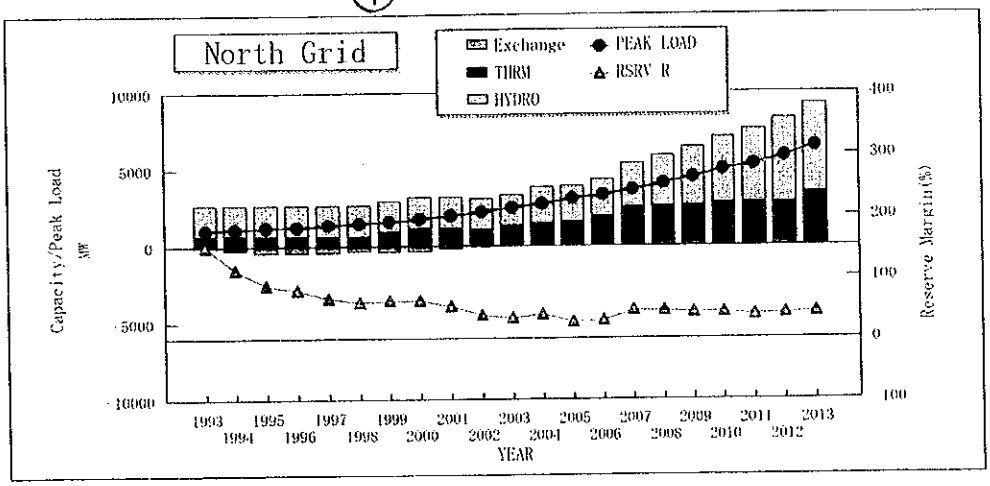


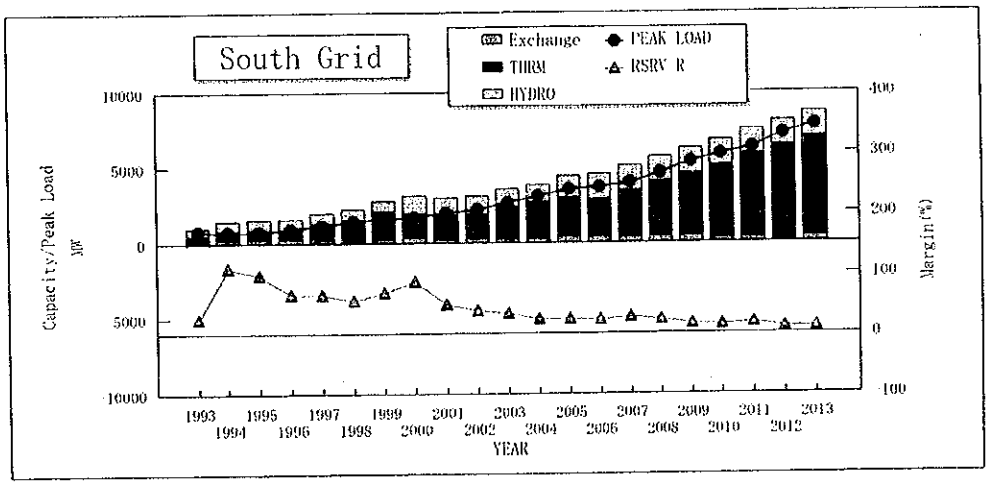
Energy Balance in all Vietnam May 30th 1995 EPDC

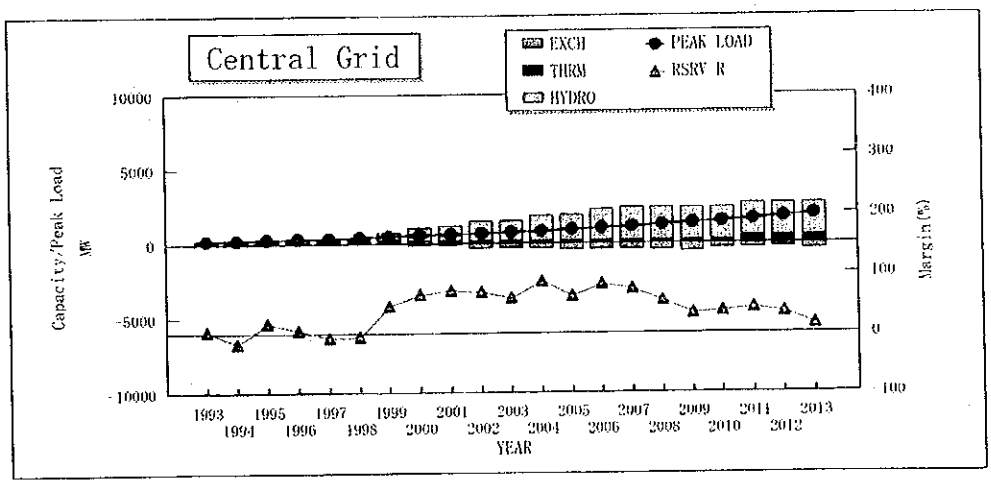


Peak Balance of Each Grid

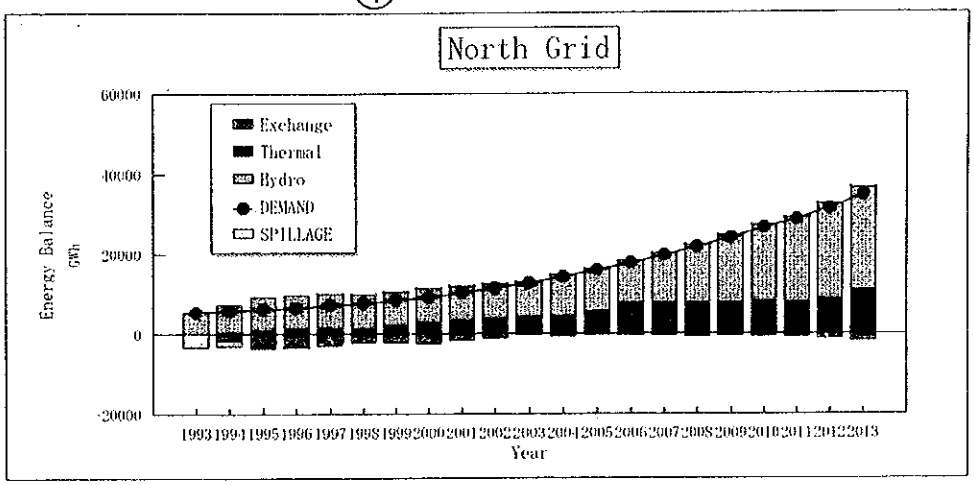
④ (Case SS/GS)

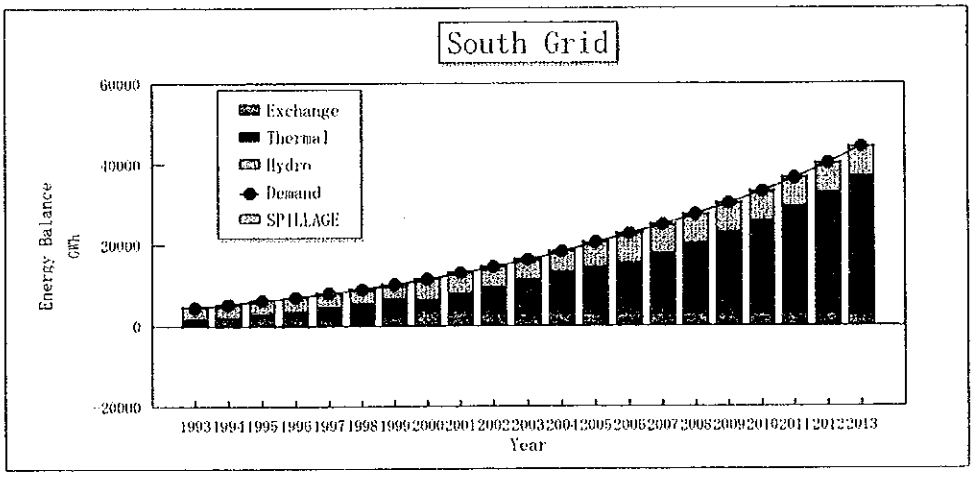


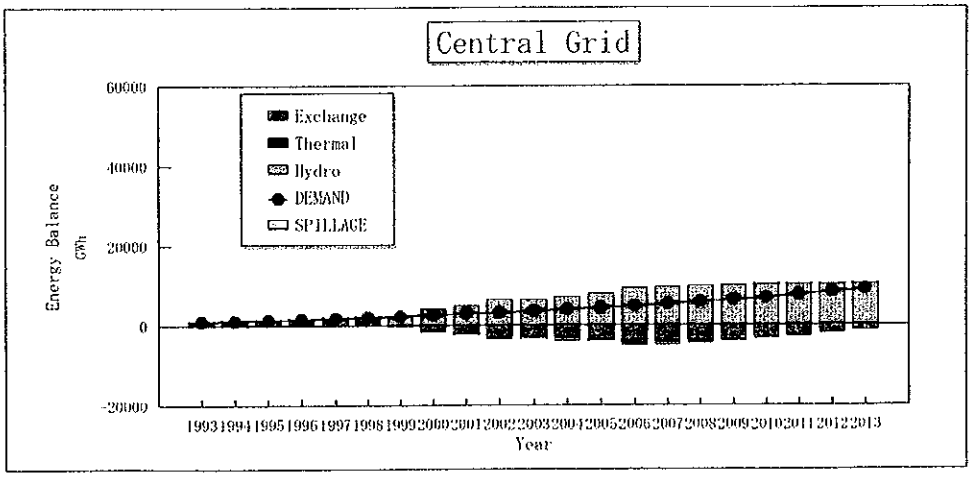




Energy Balance of Each Grid
④ (Case SS/GS)

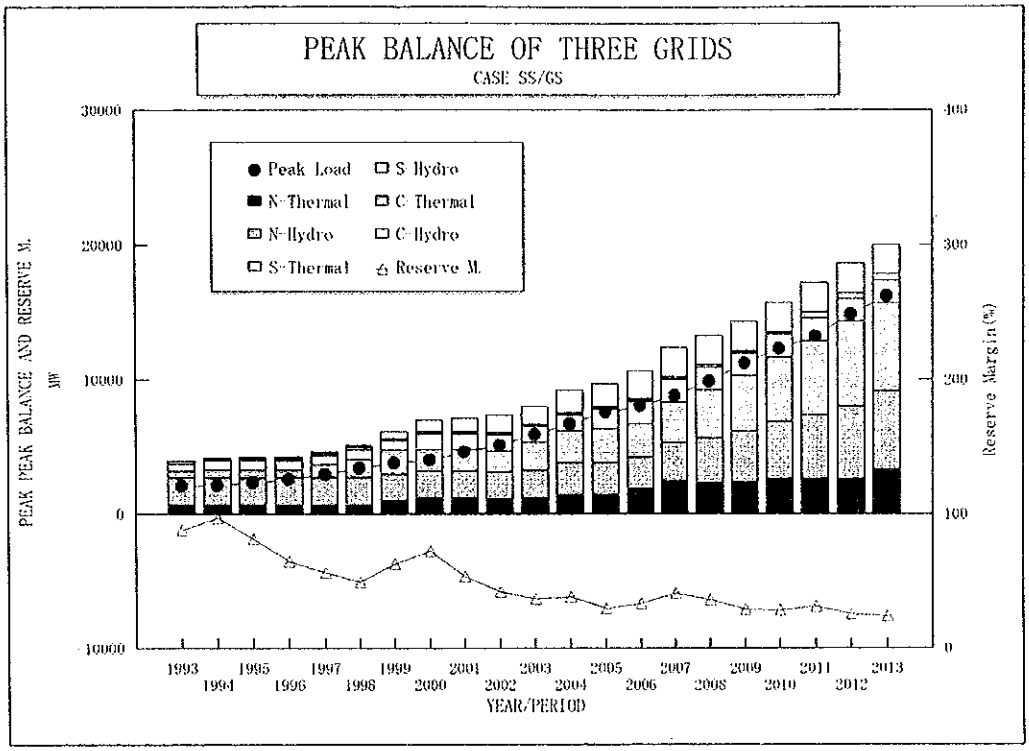






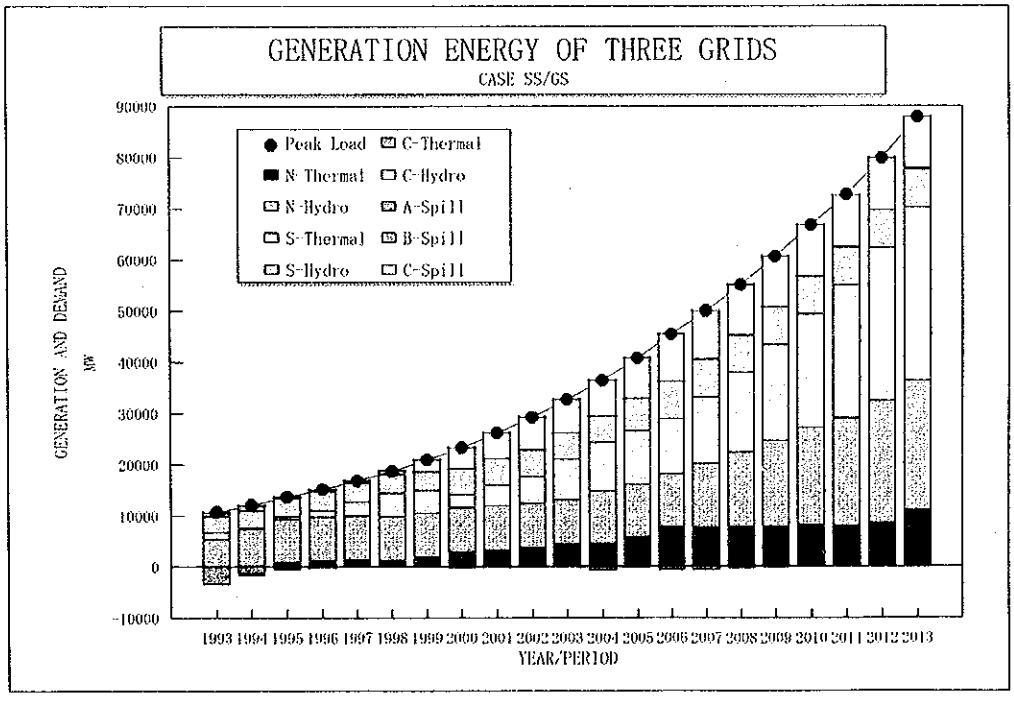
June 23rd. 1995 EPDC

Peak Balance in all Vietnam (Case-SS/GS) ④



June 23rd. 1995 EPDC

Energy Balance in all Vietnam (Case-SS/GS)

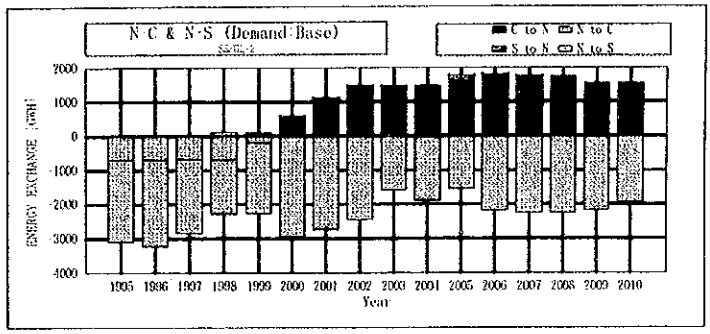


Case:SS-GL-2 June 23 (1/2) SonLa(2007yr)

EPDC

Energy flow on inter line N-C & N-S

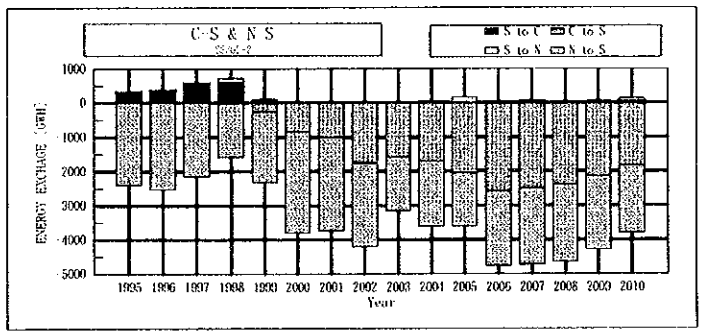
Year	energy transfer(GWh) N to C	N to S	energy transfer(GWh) C to N	S to N
1995	684.0	2405.0	0.0	0.0
1996	685.0	2533.0	0.0	0.0
1997	681.0	2150.0	0.0	0.0
1998	695.0	1581.0	0.0	124.0
1999	199.0	2062.0	85.0	18.0
2000	5.0	2947.0	557.0	0.0
2001	0.0	2730.0	1102.0	0.0
2002	0.0	2436.0	1472.0	0.0
2003	0.0	1571.0	1433.0	22.0
2004	8.0	1886.0	1451.0	29.0
2005	0.0	1551.0	1605.0	166.0
2006	0.0	2179.0	1753.0	43.0
2007	0.0	2242.0	1688.0	69.0
2008	2.0	2252.0	1718.0	25.0
2009	12.0	2159.0	1597.0	41.0
2010	1.0	1954.0	1470.0	82.0
Total	2972	34638	15871	610



Energy flow on inter line C-S & N-S

SS/GL2/2

Year	energy transfer(GWh) C to S	N to S	energy transfer(GWh) S to C	S to N
1995	0.0	2405.0	317.0	0.0
1996	0.0	2533.0	369.0	0.0
1997	0.0	2150.0	571.0	0.0
1998	1.0	1581.0	595.0	124.0
1999	258.0	2062.0	90.0	18.0
2000	847.0	2947.0	21.0	0.0
2001	1004.0	2730.0	1.0	0.0
2002	1769.0	2436.0	0.0	0.0
2003	1585.0	1571.0	0.0	22.0
2004	1713.0	1886.0	37.0	29.0
2005	2054.0	1551.0	0.0	166.0
2006	2588.0	2179.0	0.0	43.0
2007	2396.0	2242.0	4.0	69.0
2008	2398.0	2252.0	3.0	25.0
2009	2137.0	2159.0	18.0	41.0
2010	1844.0	1954.0	45.0	82.0
Total	20594	34638	2080	610

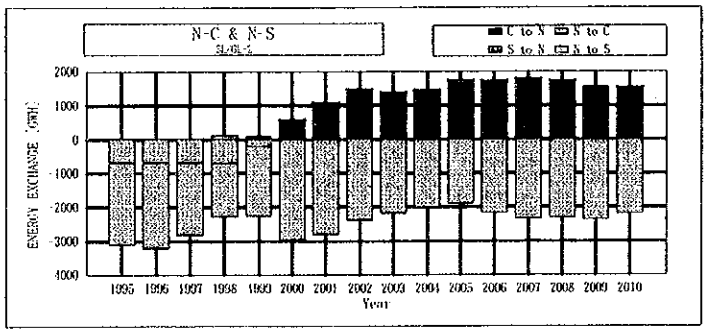


Energy Exchange Case-(3) SS/GL (Base Case)

Case:SL/GL-2 June 23 (1/2) SonLa(2007yr)

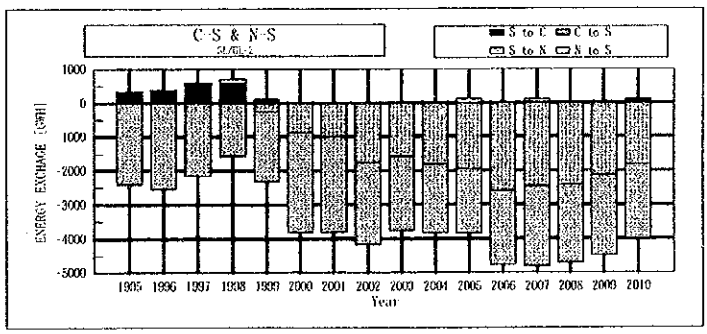
Energy flow on inter line N-C & N-S

Year	energy transfer(GWh) N to C	N to S	energy transfer(GWh) C to N	S to N
1995	684.0	2405.0	0.0	0.0
1996	685.0	2533.0	0.0	0.0
1997	681.0	2150.0	0.0	0.0
1998	695.0	1581.0	0.0	126.0
1999	199.0	2062.0	85.0	18.0
2000	4.0	2959.0	584.0	0.0
2001	4.0	2808.0	1081.0	0.0
2002	0.0	2393.0	1472.0	0.0
2003	1.0	2182.0	1379.0	0.0
2004	9.0	2007.0	1448.0	3.0
2005	0.0	1880.0	1639.0	107.0
2006	0.0	2167.0	1721.0	9.0
2007	0.0	2336.0	1695.0	95.0
2008	0.0	2297.0	1725.0	10.0
2009	12.0	2348.0	1528.0	22.0
2010	0.0	2186.0	1463.0	67.0
Total	2974	36294	15820	457



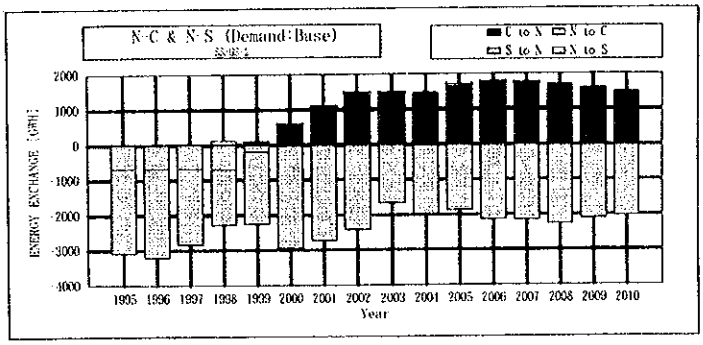
SL/GL2/2 Energy flow on inter line C-S & N-S

Year	energy transfer(GWh) C to S	N to S	energy transfer(GWh) S to C	S to N
1995	0.0	2405.0	317.0	0.0
1996	0.0	2533.0	369.0	0.0
1997	0.0	2150.0	571.0	0.0
1998	1.0	1581.0	595.0	126.0
1999	258.0	2062.0	90.0	18.0
2000	854.0	2959.0	21.0	0.0
2001	1000.0	2808.0	0.0	0.0
2002	1774.0	2393.0	0.0	0.0
2003	1588.0	2182.0	0.0	0.0
2004	1818.0	2007.0	28.0	3.0
2005	1957.0	1880.0	1.0	107.0
2006	2606.0	2167.0	0.0	9.0
2007	2475.0	2336.0	3.0	95.0
2008	2419.0	2297.0	5.0	10.0
2009	2137.0	2348.0	13.0	22.0
2010	1818.0	2186.0	36.0	67.0
Total	20705	36294	2052	457



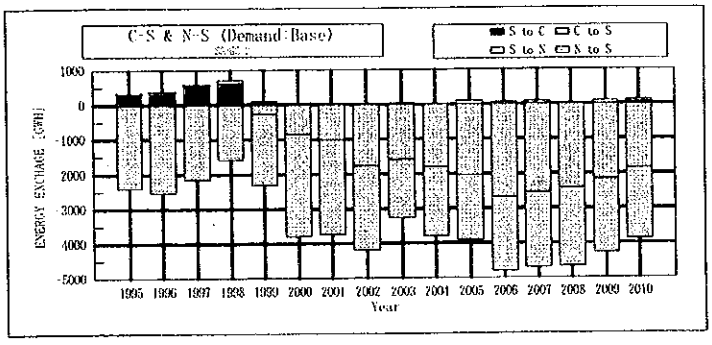
Energy Exchange Case-(1) SL/GL (Base Case)

Year	energy transfer (GWh) N to C	N to S	energy transfer (GWh) C to N	S to N
1995	684.0	2405.0	0.0	0.0
1996	685.0	2533.0	0.0	0.0
1997	681.0	2150.0	0.0	0.0
1998	695.0	1581.0	0.0	126.0
1999	199.0	2062.0	85.0	18.0
2000	5.0	2947.0	587.0	0.0
2001	0.0	2730.0	1102.0	0.0
2002	0.0	2428.0	1477.0	0.0
2003	0.0	1667.0	1444.0	42.0
2004	3.0	1979.0	1446.0	13.0
2005	0.0	1872.0	1616.0	96.0
2006	0.0	2133.0	1732.0	51.0
2007	0.0	2149.0	1687.0	74.0
2008	6.0	2257.0	1685.0	13.0
2009	11.0	2101.0	1524.0	77.0
2010	2.0	2034.0	1424.0	74.0
Total	2971	35031	15809	584



SS/GS(2/2)

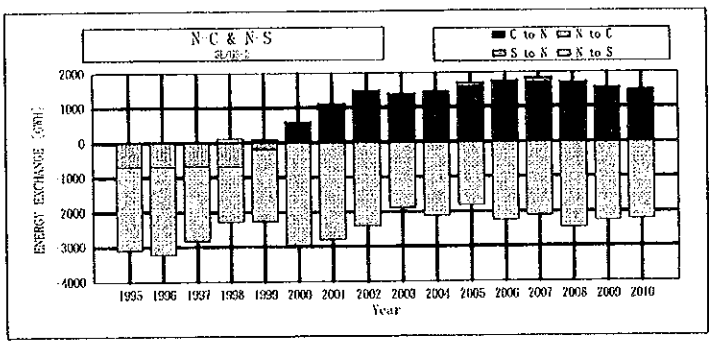
Year	energy transfer (GWh) C to S	N to S	energy transfer (GWh) S to C	S to N
1995	0.0	2405.0	317.0	0.0
1996	0.0	2533.0	369.0	0.0
1997	0.0	2150.0	574.0	0.0
1998	1.0	1581.0	595.0	126.0
1999	258.0	2062.0	90.0	18.0
2000	817.0	2947.0	24.0	0.0
2001	1004.0	2730.0	4.0	0.0
2002	1760.0	2428.0	0.0	0.0
2003	1577.0	1667.0	0.0	42.0
2004	1807.0	1979.0	14.0	13.0
2005	2035.0	1872.0	0.0	96.0
2006	2658.0	2133.0	0.0	51.0
2007	2555.0	2149.0	11.0	74.0
2008	2414.0	2257.0	5.0	13.0
2009	2167.0	2101.0	5.0	77.0
2010	1840.0	2034.0	98.0	74.0
Total	20933	35031	3046	584



Energy Exchange Case-(4) SS/GS (Base Case)

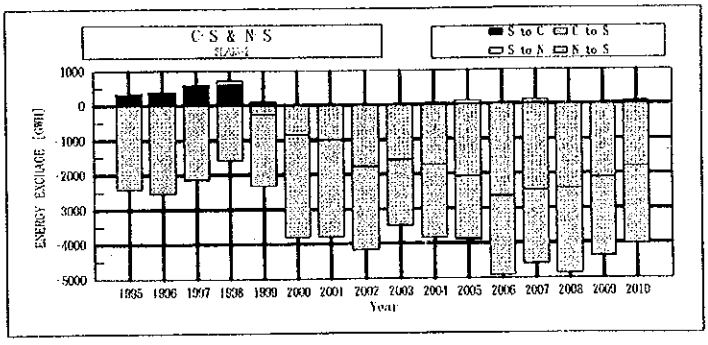
Case:SL/GS-2 June 23 (1/2) SonLa(2007yr)

Year	energy transfer (GWh) N to C	N to S	energy transfer (GWh) C to N	S to N
1995	684.0	2405.0	0.0	0.0
1996	685.0	2533.0	0.0	0.0
1997	681.0	2150.0	0.0	0.0
1998	695.0	1581.0	0.0	126.0
1999	199.0	2062.0	85.0	18.0
2000	5.0	2962.0	584.0	0.0
2001	2.0	2785.0	1088.0	0.0
2002	0.0	2393.0	1472.0	0.0
2003	0.0	1888.0	1387.0	0.0
2004	12.0	2103.0	1443.0	12.0
2005	0.0	1814.0	1583.0	106.0
2006	0.0	2257.0	1739.0	0.0
2007	0.0	2116.0	1701.0	123.0
2008	1.0	2147.0	1709.0	0.0
2009	12.0	2259.0	1534.0	12.0
2010	2.0	2225.0	1447.0	49.0
Total	2978	35982	15763	446



SL/GS(2/2)

Year	energy transfer (GWh) C to S	N to S	energy transfer (GWh) S to C	S to N
1995	0.0	2405.0	317.0	0.0
1996	0.0	2533.0	369.0	0.0
1997	0.0	2150.0	574.0	0.0
1998	1.0	1581.0	595.0	126.0
1999	258.0	2062.0	90.0	18.0
2000	846.0	2962.0	24.0	0.0
2001	1006.0	2785.0	3.0	0.0
2002	1774.0	2393.0	0.0	0.0
2003	1592.0	1888.0	0.0	0.0
2004	1726.0	2103.0	27.0	12.0
2005	2086.0	1814.0	0.0	106.0
2006	2654.0	2257.0	0.0	0.0
2007	2476.0	2116.0	12.0	123.0
2008	2417.0	2447.0	2.0	0.0
2009	2115.0	2259.0	19.0	12.0
2010	1895.0	2225.0	36.0	49.0
Total	20756	35982	2070	446



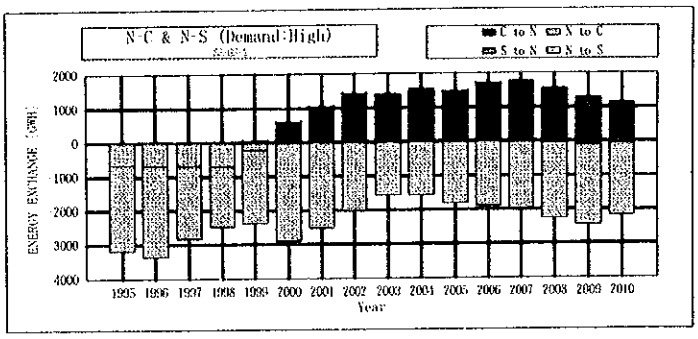
Energy Exchange Case-(2) SL/GS (Base Case)

Case:SS/GS 2 June 24th (1/2) Sonda(2007yr) Demand:High

EPDC

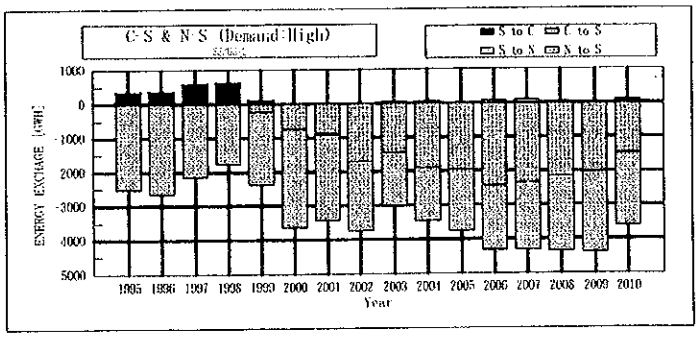
Energy flow on inter line N-C & N-S

Year	energy transfer(GWh) N to C	N to S	energy transfer(GWh) C to N	S to N
1995	664.0	2513.0	0.0	0.0
1996	698.0	2655.0	0.0	0.0
1997	693.0	2136.0	0.0	0.0
1998	705.0	1772.0	0.0	5.0
1999	225.0	2148.0	53.0	0.0
2000	15.0	2884.0	608.0	0.0
2001	0.0	2524.0	1034.0	0.0
2002	0.0	2039.0	1421.0	12.0
2003	0.0	1557.0	1362.0	55.0
2004	2.0	1569.0	1484.0	60.0
2005	0.0	1802.0	1457.0	15.0
2006	0.0	1896.0	1637.0	67.0
2007	13.0	1977.0	1693.0	88.0
2008	37.0	2215.0	1524.0	41.0
2009	84.0	2366.0	1268.0	15.0
2010	53.0	2126.0	1126.0	27.0
Total	3195	34179	14667	385



SS/GS(2/2) Energy flow on inter line C-S & N-S Demand:High

Year	energy transfer(GWh) C to S	N to S	energy transfer(GWh) S to C	S to N
1995	0.0	2513.0	342.0	0.0
1996	0.0	2655.0	370.0	0.0
1997	0.0	2136.0	588.0	0.0
1998	0.0	1772.0	616.0	5.0
1999	232.0	2148.0	106.0	0.0
2000	751.0	2884.0	24.0	0.0
2001	906.0	2524.0	0.0	0.0
2002	1700.0	2039.0	0.0	12.0
2003	1410.0	1557.0	0.0	55.0
2004	1894.0	1569.0	0.0	60.0
2005	1963.0	1802.0	5.0	15.0
2006	2435.0	1896.0	8.0	67.0
2007	2362.0	1977.0	0.0	88.0
2008	2149.0	2215.0	6.0	41.0
2009	2039.0	2366.0	18.0	15.0
2010	1481.0	2126.0	67.0	27.0
Total	19332	34179	2150	385

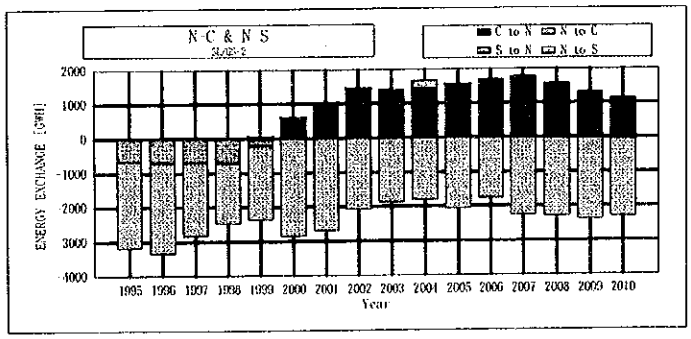


Energy Exchange Case-(8) SS/GS (High Case)

Case:SL/GS-2 June 23rd. (1/2) Sonda(2007yr)

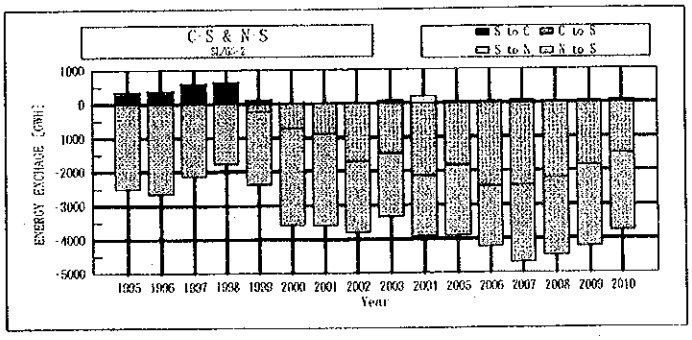
Energy flow on inter line N-C & N-S Demand:High

Year	energy transfer(GWh) N to C	N to S	energy transfer(GWh) C to N	S to N
1995	664.0	2513.0	0.0	0.0
1996	698.0	2655.0	0.0	0.0
1997	693.0	2136.0	0.0	0.0
1998	705.0	1772.0	0.0	5.0
1999	225.0	2148.0	53.0	0.0
2000	15.0	2834.0	608.0	0.0
2001	0.0	2682.0	1024.0	0.0
2002	0.0	2068.0	1423.0	21.0
2003	9.0	1854.0	1351.0	52.0
2004	9.0	1892.0	1453.0	210.0
2005	0.0	2054.0	1530.0	27.0
2006	1.0	1760.0	1690.0	13.0
2007	1.0	2269.0	1700.0	74.0
2008	28.0	2261.0	1552.0	14.0
2009	30.0	2360.0	1303.0	21.0
2010	53.0	2251.0	1132.0	15.0
Total	3131	35419	14811	452



SL/GS(2/2) Energy flow on inter line C-S & N-S

Year	energy transfer(GWh) C to S	N to S	energy transfer(GWh) S to C	S to N
1995	0.0	2513.0	342.0	0.0
1996	0.0	2655.0	370.0	0.0
1997	0.0	2136.0	588.0	0.0
1998	0.0	1772.0	616.0	5.0
1999	232.0	2148.0	106.0	0.0
2000	741.0	2834.0	24.0	0.0
2001	904.0	2682.0	1.0	0.0
2002	1726.0	2068.0	0.0	21.0
2003	1487.0	1854.0	41.0	52.0
2004	2132.0	1892.0	0.0	210.0
2005	1850.0	2054.0	9.0	27.0
2006	2467.0	1760.0	22.0	13.0
2007	2428.0	2269.0	0.0	74.0
2008	2223.0	2261.0	5.0	14.0
2009	1563.0	2360.0	22.0	21.0
2010	1508.0	2251.0	76.0	15.0
Total	19556	35419	2222	452



Energy Exchange Case-(6) SL/GS (High Case)

(yr. 1993 ~ 2013) Case① : SL/GL (Son La Large+Gas Large)

TABLE 4.1 COST AND RELIABILITY COMPARISON BEFORE AND AFTER INTERCONNECTION

(ISOLATED/CONNECTED)

	NORTH	SOUTH	CENTER	TOTAL
COST(K$):TOTAL	4069885	4845632	795679	9711197
	3894414	4054034	1143233	9091683
CAPITAL	3503631	2454219	553393	6511244
	3299818	2287133	1040583	6627534
OPERATION	566254	2391411	242286	3199951
	594596	1766900	102651	2464147
FUEL	324932	1798585	215195	2338712
	371622	1313731	86301	1771654
O & M	241321	592826	27091	861239
	222974	453169	16350	692493
LOLP	1.34	3.98	28.24	11.18
(DAYS/YEAR)	1.84	1.54	6.91	3.43
UNSERVED ENERGY	111.6	226.4	918.0	1256.0
(GWH)	168.4	105.0	253.3	526.7

Case② : SL/GS (Son La Large+Gas Small)

TABLE 4.1 COST AND RELIABILITY COMPARISON BEFORE AND AFTER INTERCONNECTION

(ISOLATED/CONNECTED)

	NORTH	SOUTH	CENTER	TOTAL
COST(K$):TOTAL	4069885	5112549	795679	9978114
	3988360	4281106	1128291	9397757
CAPITAL	3503631	2763343	553393	6820368
	3423821	2536520	1025805	6986147
OPERATION	566254	2349204	242286	3157744
	564538	1744584	102486	2411608
FUEL	324932	1755249	215195	2295376
	349226	1285385	86149	1720759
O & M	241321	593956	27091	862368
	215312	459200	16337	690849
LOLP	1.34	5.10	28.24	11.56
(DAYS/YEAR)	1.95	1.49	6.37	3.27
UNSERVED ENERGY	111.6	383.5	918.0	1413.1
(GWH)	179.9	100.1	220.1	500.0

(1993 ~ 2013) Case③ : SS/GL (Son La Small+Gas Large)

TABLE 4.1 COST AND RELIABILITY COMPARISON BEFORE AND AFTER INTERCONNECTION

(ISOLATED/CONNECTED)

	NORTH	SOUTH	CENTER	TOTAL
COST(K$):TOTAL	3554801	4843855	795679	9194335
	3256874	4088302	1142668	8487845
CAPITAL	3037778	2454219	553393	6045391
	2585601	2316502	1040583	5942687
OPERATION	517023	2389634	242286	3148943
	671273	1771798	102085	2545157
FUEL	287004	1796808	215195	2299007
	422362	1316212	85779	1824352
O & M	230019	592826	27091	849936
	248911	455587	16306	720804
LOLP	1.08	3.98	28.24	11.10
(DAYS/YEAR)	1.85	1.53	5.97	3.12
UNSERVED ENERGY	79.0	226.4	918.0	1223.4
(GWH)	167.7	104.4	220.3	492.5

Case④ : SS/GS (Son La Small+Gas Small)

TABLE 4.1 COST AND RELIABILITY COMPARISON BEFORE AND AFTER INTERCONNECTION

(ISOLATED/CONNECTED)

	NORTH	SOUTH	CENTER	TOTAL
COST(K$):TOTAL	3554801	5122197	795679	9472678
	3455978	4285729	1142472	8884181
CAPITAL	3037778	2738965	553393	6330137
	2760986	2553406	1040583	6354976
OPERATION	517023	2383231	242286	3142539
	694992	1732322	101890	2529204
FUEL	287004	1780202	215195	2282401
	435505	1275970	85599	1797074
O & M	230019	603029	27091	860138
	259487	456351	16291	732130
LOLP	1.08	5.30	28.24	11.54
(DAYS/YEAR)	1.82	1.38	6.04	3.08
UNSERVED ENERGY	79.0	409.9	918.0	1406.9
(GWH)	165.5	93.8	208.1	467.4

(1993 ~ 2013) Case01 : NS/GL (No-Son La+Gas Large)

TABLE 4.1 COST AND RELIABILITY COMPARISON BEFORE AND AFTER INTERCONNECTION

(ISOLATED/CONNECTED)

	NORTH	SOUTH	CENTER	TOTAL
COST(K$):TOTAL	3319079	4851308	795679	8966066
	3178788	4095565	1124003	8398357
CAPITAL	2521062	2509620	553393	5584076
	2315917	2376238	1020709	5712865
OPERATION	798016	2341686	242286	3381989
	862871	1719325	103295	2685491
FUEL	484758	1759175	215195	2459128
	553331	1275793	86895	1916020
O & M	313258	582512	27091	922861
	309540	443532	16399	769471
LOLP	1.26	4.17	28.24	11.22
(DAYS/YEAR)	1.83	1.26	5.86	2.99
UNSERVED ENERGY	105.6	238.1	918.0	1261.7
(GWH)	177.4	82.5	201.5	461.4

Case02 : NS/GS (No-Son La+Gas Small)

TABLE 4.1 COST AND RELIABILITY COMPARISON BEFORE AND AFTER INTERCONNECTION

(ISOLATED/CONNECTED)

	NORTH	SOUTH	CENTER	TOTAL
COST(K$):TOTAL	3319079	5338685	795679	9453444
	3211242	4517570	1135754	8864567
CAPITAL	2521062	3007765	553393	6082221
	2314102	2799735	1031376	6145214
OPERATION	798016	2330919	242286	3371222
	897140	1717834	104378	2719352
FUEL	484758	1738345	215195	2438298
	575138	1264717	87895	1927750
O & M	313258	592574	27091	932923
	322002	453117	16483	791602
LOLP	1.26	4.23	28.24	11.24
(DAYS/YEAR)	1.72	1.45	6.22	3.13
UNSERVED ENERGY	105.6	241.9	918.0	1265.5
(GWH)	174.4	92.3	211.5	478.2

(1993 ~ 2013) Case⑤ : SL/GL (Son La Large+Gas Large)

TABLE 4.1 COST AND RELIABILITY COMPARISON BEFORE AND AFTER INTERCONNECTION

(ISOLATED/CONNECTED)

	NORTH	SOUTH	CENTER	TOTAL
COST(K$):TOTAL	4390776	5658274	940214	10989265
	4480790	4952842	1147250	10580882
CAPITAL	3824231	3013502	685204	7522938
	3824628	2854074	1040583	7719286
OPERATION	566546	2644770	255010	3466325
	656161	2098766	106667	2861595
FUEL	326659	1986405	226940	2540003
	410749	1559869	90008	2060626
O & M	239887	658365	28070	926322
	245412	538898	16659	800968
LOLP	1.52	4.99	30.04	12.18
(DAYS/YEAR)	1.93	1.35	6.56	3.28
UNSERVED ENERGY	121.1	327.9	1017.3	1466.4
(GWH)	175.2	108.4	233.5	517.1

Case⑥ : SL/GS (Son La Large+Gas Small)

TABLE 4.1 COST AND RELIABILITY COMPARISON BEFORE AND AFTER INTERCONNECTION

(ISOLATED/CONNECTED)

	NORTH	SOUTH	CENTER	TOTAL
COST(K$):TOTAL	4390776	5913206	940214	11244197
	4565726	5164095	1151743	10881565
CAPITAL	3824231	3313866	685204	7823301
	3823976	3139568	1040583	8004128
OPERATION	566546	2599338	255010	3420894
	741750	2024526	111161	2877436
FUEL	326659	1946821	226940	2500419
	467994	1495363	94156	2057513
O & M	239887	652518	28070	920474
	273755	529163	17005	819923
LOLP	1.52	9.50	30.04	13.69
(DAYS/YEAR)	2.09	1.67	8.81	4.19
UNSERVED ENERGY	121.1	932.2	1017.3	2070.7
(GWH)	197.6	132.8	399.4	729.8

(1993 ~ 2013) Case⑦ : SS/GL (Son La Small+Gas Large)

TABLE 4.1 COST AND RELIABILITY COMPARISON BEFORE AND AFTER INTERCONNECTION

(ISOLATED/CONNECTED)

	NORTH	SOUTH	CENTER	TOTAL
COST(K$):TOTAL	3843159	5660656	940214	10444029
	3772669	4935944	1148098	9856712
CAPITAL	3251097	2997339	685204	6933641
	3027696	2850631	1040583	6918911
OPERATION	592062	2663315	255010	3510386
	744973	2085311	107515	2937799
FUEL	338555	1999595	226940	2565090
	469188	1550569	90791	2110548
O & M	253507	663720	28070	945297
	275785	534742	16724	827251
LOLP	1.62	4.94	30.04	12.20
(DAYS/YEAR)	1.95	1.47	6.68	3.37
UNSERVED ENERGY	120.3	323.3	1017.3	1460.9
(GWH)	174.3	105.7	244.5	524.6

Case⑧ : SS/GS (Son La Small+Gas Small)

TABLE 4.1 COST AND RELIABILITY COMPARISON BEFORE AND AFTER INTERCONNECTION

(ISOLATED/CONNECTED)

	NORTH	SOUTH	CENTER	TOTAL
COST(K$):TOTAL	3843159	5915824	940214	10699197
	3899635	5157939	1148277	10205852
CAPITAL	3251097	3284710	685204	7221012
	3108572	3133989	1034995	7277557
OPERATION	592062	2631112	255010	3478184
	791063	2023949	113282	2928294
FUEL	338555	1969917	226940	2535412
	498844	1497041	96114	2091999
O & M	253507	661196	28070	942772
	292220	526908	17168	836295
LOLP	1.62	10.36	30.04	14.01
(DAYS/YEAR)	2.08	1.82	8.50	4.13
UNSERVED ENERGY	120.3	1209.7	1017.3	2347.3
(GWH)	191.7	138.8	395.2	725.8

(1993 ~ 2013) Case⑨ : Delayed SonLa(L)(2yr.)

TABLE 4.1 COST AND RELIABILITY COMPARISON BEFORE AND AFTER INTERCONNECTION

(ISOLATED/CONNECTED)

	NORTH	SOUTH	CENTER	TOTAL
COST(K$):TOTAL	4011789	5112549	795679	9920018
	4052274	4276658	1133894	9462827
CAPITAL	3355393	2763343	553393	6672130
	3256834	2553087	1031376	6841298
OPERATION	656396	2349204	242286	3247887
	795440	1723570	102518	2621528
FUEL	389589	1755249	215195	2360032
	507682	1269252	86179	1863113
O & M	266807	593956	27091	887854
	287758	454317	16340	758415
LOLP	1.41	5.10	28.24	11.58
(DAYS/YEAR)	1.87	1.40	6.83	3.37
UNSERVED ENERGY	113.7	383.5	918.0	1415.3
(GWH)	188.1	92.7	243.9	524.7

Case⑩ : Delayed SonLa(S)(2yr.)

TABLE 4.1 COST AND RELIABILITY COMPARISON BEFORE AND AFTER INTERCONNECTION

(ISOLATED/CONNECTED)

	NORTH	SOUTH	CENTER	TOTAL
COST(K$):TOTAL	3659080	5122197	795679	9576957
	3578191	4284687	1142740	9005618
CAPITAL	3019377	2738965	553393	6311736
	2742727	2553406	1040583	6336716
OPERATION	639703	2383231	242286	3265220
	835464	1731280	102157	2668901
FUEL	374010	1780202	215195	2369407
	532212	1275160	85845	1893218
O & M	265694	603029	27091	895813
	303251	456120	16312	775683
LOLP	1.30	5.30	28.24	11.61
(DAYS/YEAR)	1.86	1.41	5.98	3.08
UNSERVED ENERGY	98.4	409.9	918.0	1426.4
(GWH)	182.4	92.0	204.2	478.5

(yr. 1993 ~ 2013)

TABLE 4.1 COST AND RELIABILITY COMPARISON BEFORE AND AFTER INTERCONNECTION

(ISOLATED/CONNECTED)

	NORTH	SOUTH	CENTER	TOTAL
COST(K$):TOTAL	3309948	4964148	764350	9038445
	3175979	4073034	1110465	8359479
CAPITAL	2831278	2617353	493790	5942421
	2436307	2303924	998488	5738719
OPERATION	478670	2346793	270559	3096023
	739672	1769109	111978	2620759
FUEL	268319	1765675	241293	2275287
	477537	1315803	94910	1888251
O & M	210351	581119	29266	820736
	262135	453306	17067	732508
LOLP	3.89	7.92	30.03	13.95
(DAYS/YEAR)	4.72	3.70	8.48	5.63
UNSERVED ENERGY	321.0	646.4	987.6	1954.9
(GWH)	409.0	287.0	337.0	1033.0

Riliability (LOLP=3.0%)

Case⑪ : SS/GS , Demand: JICA Base

Appendix Commissioning Year of Each Power Plant (Case-SL/GL)

DM: Base Case (1)

Northern Region

TABLE 5.1.1 ADDITION UNITS AFTER INTERCONNECTION OF NORTH

NAME:	HBAN	HCUA	HSON	HSON	HSON	HSON	LOLP	
		HDAI	HSON	HSON	HSON	CQUA		
CAP.:	350	105	600	600	600	600	MAINT	NOMNT
YEAR	CAP.	250	600	600	600	300	(DAYS/YEAR)	
1993	0	0 0	0 0	0 0	0 0	0 0	0.0	0.23
1994	0	0 0	0 0	0 0	0 0	0 0	0.45	0.79
1995	0	0 0	0 0	0 0	0 0	0 0	0.76	1.70
1996	0	0 0	0 0	0 0	0 0	0 0	1.06	1.89
1997	0	0 0	0 0	0 0	0 0	0 0	1.62	1.95
1998	0	0 0	0 0	0 0	0 0	0 0	1.60	1.95
1999	0	0 0	0 0	0 0	0 0	0 0	0.96	1.25
2000	0	0 0	0 0	0 0	0 0	0 0	0.90	1.09
2001	0	0 0	0 0	0 0	0 0	0 0	1.22	1.46
2002	0	0 0	0 0	0 0	0 0	0 0	1.86	1.96
2003	350	1 0	0 0	0 0	0 0	0 0	1.59	1.27
2004	300	0 0	0 0	0 0	0 0	0 1	1.96	0.92
2005	0	0 0	0 0	0 0	0 0	0 0	3.30	1.48
2006	600	0 0	0 0	0 0	0 0	0 2	2.57	1.05
2007	900	0 0	0 1	0 0	0 0	0 1	2.82	0.24
2008	600	0 0	0 0	1 0	0 0	0 0	1.46	0.15
2009	600	0 0	0 0	0 1	0 0	0 0	2.54	0.09
2010	600	0 0	0 0	0 0	1 0	0 0	3.11	0.04
2011	600	0 0	0 0	0 0	0 1	0 0	2.69	0.01
2012	705	0 0	1 0	0 0	0 0	1 0	2.94	0.02
2013	1150	0 1	0 0	0 0	0 0	0 3	3.18	0.00
TOTAL	6405	1 1	1 1	1 1	1 1	1 7		

HBAN: Ban Mai HDAI: Dai Thi HCUA: Cua Dat HSON: Son La

COUA: Quan Ninh

Southern Region

TABLE 5.1.2 ADDITION UNITS AFTER INTERCONNE

NAME:	HDAI	NEW	NEW+	LOLP	
	HDON				
CAP.:	300	300		MAINT	NOMNT
YEAR	CAP.	200	300	(DAYS/YEAR)	
1993	0	0 0	0	0.17	0.39
1994	0	0 0	0	0.00	0.00
1995	0	0 0	0	0.01	0.02
1996	0	0 0	0	3.01	0.12
1997	0	0 0	0	0.31	0.07
1998	0	0 0	0	1.12	0.10
1999	0	0 0	0	0.20	0.09
2000	0	0 0	0	0.06	0.0
2001	0	0 0	0	0.05	0.03
2002	0	0 0	0	1.21	0.13
2003	300	0 0	1 0	1.48	0.30
2004	300	0 0	1 0	2.65	0.52
2005	900	0 0	3 0	2.38	0.23
2006	200	0 1	0 0	2.20	0.23
2007	600	0 0	2 0	2.20	0.10
2008	300	0 0	1 0	2.64	0.17
2009	600	0 0	2 0	2.85	0.20
2010	900	1 0	0 2	2.74	0.10
2011	900	0 0	0 3	2.49	0.05
2012	1200	0 0	0 4	2.06	0.03
2013	900	0 0	0 3	2.61	0.04
TOTAL	7100	1 1	10 12		

HDAI: Dai Ninh HDON: Dong Nai4

NEW: New G.C/C NEW+: New Coal

Central Region

TABLE 5.1.3 ADDITION UNITS AFTER INTERCONNECTION OF CENTER

NAME:	HSE	HSE	HAN	HRAO		LOLP	
	HBUO	HPLI	HSON	HTHU			
CAP.:	220	366	116	80		MAINT	NOMNT
YEAR	CAP.	81	120	60	260	(DAYS/YEAR)	
1993	0	0 0	0 0	0 0	0 0	36.52	36.51
1994	0	0 0	0 0	0 0	0 0	57.06	47.15
1995	0	0 0	0 0	0 0	0 0	0.0	0.0
1996	0	0 0	0 0	0 0	0 0	0.0	0.0
1997	0	0 0	0 0	0 0	0 0	1.56	1.57
1998	0	0 0	0 0	0 0	0 0	2.72	2.33
1999	0	0 0	0 0	0 0	0 0	1.45	0.35
2000	0	0 0	0 0	0 0	0 0	0.01	0.10
2001	120	0 0	0 1	0 0	0 0	2.06	0.16
2002	301	1 1	0 0	0 0	0 0	0.02	0.04
2003	0	0 0	0 0	0 0	0 0	3.60	0.10
2004	376	0 0	0 0	1 0	0 1	4.23	0.00
2005	60	0 0	0 0	0 1	0 0	4.23	0.01
2006	366	0 0	1 0	0 0	0 0	0.80	0.01
2007	80	0 0	0 0	0 1	0 0	4.27	0.0
2008	0	0 0	0 0	0 0	0 0	5.93	0.01
2009	0	0 0	0 0	0 0	0 0	11.89	0.01
2010	0	0 0	0 0	0 0	0 0	5.18	0.00
2011	0	0 0	0 0	0 0	0 0	1.14	0.01
2012	0	0 0	0 0	0 0	0 0	0.68	0.01
2013	0	0 0	0 0	0 0	0 0	1.64	0.01
TOTAL	1303	1 1	1 1	1 1	1 1		

HSE: Se San#3 HBUO: Buon Cuop HSE: SeSan#4 HPLI: Plei Krung

HAN: An Khe HSON: Son Con2 HRAO: Rao Quan HTHU: Thuong Kon Tum

Commissioning Year of Each Power Plant (Case-SL/GS) ②

Northern Region

TABLE 5.1.1 ADDITION UNITS AFTER INTERCONNECTION OF NORTH

NAME:	HBAN	HCUA	HSON	HSON	HSON						LOLP	
		HDAI	HSON	HSON	HSON	COUA						
CAP.:	350		105	600	600	600					MAINT	NOMNT
YEAR	CAP.	250	600	600	600	300					(DAYS/YEAR)	
1993	0	0	0	0	0	0	0	0	0	0	0.0	0.23
1994	0	0	0	0	0	0	0	0	0	0	0.45	0.79
1995	0	0	0	0	0	0	0	0	0	0	0.76	1.70
1996	0	0	0	0	0	0	0	0	0	0	1.06	1.89
1997	0	0	0	0	0	0	0	0	0	0	1.62	1.95
1998	0	0	0	0	0	0	0	0	0	0	1.60	1.95
1999	0	0	0	0	0	0	0	0	0	0	0.96	1.25
2000	0	0	0	0	0	0	0	0	0	0	0.89	1.08
2001	0	0	0	0	0	0	0	0	0	0	1.21	1.45
2002	0	0	0	0	0	0	0	0	0	0	1.86	1.96
2003	250	0	1	0	0	0	0	0	0	0	1.83	1.62
2004	300	0	0	0	0	0	0	0	0	1	1.91	1.17
2005	0	0	0	0	0	0	0	0	0	0	3.25	1.74
2006	950	1	0	0	0	0	0	0	0	2	2.38	0.54
2007	600	0	0	0	1	0	0	0	0	0	2.47	0.17
2008	900	0	0	0	0	1	0	0	0	1	1.79	0.06
2009	600	0	0	0	0	0	1	0	0	0	2.16	0.03
2010	600	0	0	0	0	0	0	1	0	0	2.55	0.02
2011	600	0	0	0	0	0	0	0	1	0	2.33	0.01
2012	705	0	0	1	0	0	0	0	0	1	3.22	0.00
2013	1200	0	0	0	0	0	0	0	0	0	4	6.73	0.01
TOTAL	6705	1	1	1	1	1	1	1	1	1	8		

HBAN: Ban Mai HDAI: Dai Thi HCUA: Cua Dat

COUA: Ouan Ninh HSON: Son La

Southern Region

TABLE 5.1.2 ADDITION UNITS AFTER INTERCONNE

NAME:	HDAI	NEW			LOLP	
		HDON	NEW+			
CAP.:	300	300			MAINT	NOMNT
YEAR	CAP.	200	300		(DAYS/YEAR)	
1993	0	0	0	0	0.17	0.39
1994	0	0	0	0	0.00	0.00
1995	0	0	0	0	0.01	0.02
1996	0	0	0	0	3.01	0.12
1997	0	0	0	0	0.31	0.07
1998	0	0	0	0	1.12	0.10
1999	0	0	0	0	0.20	0.09
2000	0	0	0	0	0.03	0.01
2001	0	0	0	0	0.09	0.03
2002	0	0	0	0	1.21	0.13
2003	300	0	0	1	0	1.86	0.49
2004	600	0	0	2	0	0.94	0.17
2005	600	1	0	0	1	1.88	0.17
2006	0	0	0	0	0	2.44	0.27
2007	1200	0	0	0	4	1.22	0.02
2008	0	0	0	0	0	1.91	0.10
2009	800	0	1	0	2	2.04	0.04
2010	900	0	0	0	3	2.39	0.04
2011	900	0	0	0	3	2.28	0.01
2012	900	0	0	0	3	2.94	0.01
2013	300	0	0	0	1	5.28	0.04
TOTAL	6500	1	1	3	17		

HDAI: Dai Ninh HDON: Dong Nai4

NEW: New G.C/C NEW+: New Coal

Central Region

TABLE 5.1.3 ADDITION UNITS AFTER INTERCONNECTION OF CENTER

NAME:	HSE	HSE	HAN	HRAO						LOLP	
		HBUO	HPLI	HSON	HTHU						
CAP.:	220	366	116	80						MAINT	NOMNT
YEAR	CAP.	81	120	60	260						(DAYS/YEAR)	
1993	0	0	0	0	0	0	0	0	0	0	36.52	36.51
1994	0	0	0	0	0	0	0	0	0	0	57.06	47.15
1995	0	0	0	0	0	0	0	0	0	0	0.0	0.0
1996	0	0	0	0	0	0	0	0	0	0	0.0	0.0
1997	0	0	0	0	0	0	0	0	0	0	1.56	1.57
1998	0	0	0	0	0	0	0	0	0	0	2.72	2.33
1999	0	0	0	0	0	0	0	0	0	0	1.45	0.35
2000	0	0	0	0	0	0	0	0	0	0	0.01	0.11
2001	120	0	0	0	1	0	0	0	0	0	2.15	0.17
2002	301	1	1	0	0	0	0	0	0	0	0.02	0.04
2003	0	0	0	0	0	0	0	0	0	0	0.70	0.11
2004	116	0	0	0	0	1	0	0	0	0	3.27	0.07
2005	320	0	0	0	0	0	1	0	1	0	4.64	0.02
2006	366	0	0	1	0	0	0	0	0	0	4.29	0.0
2007	80	0	0	0	0	0	0	1	0	0	2.43	0.00
2008	0	0	0	0	0	0	0	0	0	0	2.05	0.00
2009	0	0	0	0	0	0	0	0	0	0	1.30	0.0
2010	0	0	0	0	0	0	0	0	0	0	4.24	0.00
2011	0	0	0	0	0	0	0	0	0	0	0.82	0.00
2012	0	0	0	0	0	0	0	0	0	0	1.54	0.01
2013	0	0	0	0	0	0	0	0	0	0	6.95	0.01
TOTAL	1303	1	1	1	1	1	1	1	1	1		

HSE: Se San#3 HBUO: Buon Cuop HSE: SeSan#4 HPLI: Plei Krung

HAN: An Khe HSON: Son Con2 HRAO: Rao Quan HTHU: Thuong Kon Tum

Appendix Commissioning Year of Each Power Plant (Case-SS/GL) ③

Northern Region

TABLE 5.1.1 ADDITION UNITS AFTER INTERCONNECTION OF NORTH

NAME:	HBAN	HCUA	HSON	HSON	CQUA	HHOU		LOLP	
	HDAI	HSON	HSON	HSON	HHOU				
CAP.:	350	105	480	480	480	300	400	MAINT	NOMNT
YEAR CAP.	250	480	480	480	400			(DAYS/YEAR)	
1993 0	0 0	0 0	0 0	0 0	0 0	0	0	0.0	0.23
1994 0	0 0	0 0	0 0	0 0	0 0	0	0	0.45	0.79
1995 0	0 0	0 0	0 0	0 0	0 0	0	0	0.76	1.70
1996 0	0 0	0 0	0 0	0 0	0 0	0	0	1.06	1.89
1997 0	0 0	0 0	0 0	0 0	0 0	0	0	1.62	1.95
1998 0	0 0	0 0	0 0	0 0	0 0	0	0	1.59	1.93
1999 0	0 0	0 0	0 0	0 0	0 0	0	0	0.96	1.25
2000 0	0 0	0 0	0 0	0 0	0 0	0	0	0.86	1.08
2001 0	0 0	0 0	0 0	0 0	0 0	0	0	1.16	1.50
2002 0	0 0	0 0	0 0	0 0	0 0	0	0	1.69	1.97
2003 0	0 0	0 0	0 0	0 0	0 0	0	0	1.88	1.90
2004 300	0 0	0 0	0 0	0 0	1 0	0	0	2.65	2.37
2005 250	0 1	0 0	0 0	0 0	0 0	0	0	2.88	1.83
2006 600	0 0	0 0	0 0	0 0	2 0	0	0	2.62	1.20
2007 1430	1 0	0 1	0 0	0 0	2 0	0	0	3.08	0.09
2008 480	0 0	0 0	1 0	0 0	0 0	0	0	2.17	0.06
2009 780	0 0	0 0	0 1	0 0	1 0	0	0	2.14	0.04
2010 480	0 0	0 0	0 0	1 0	0 0	0	0	2.82	0.02
2011 480	0 0	0 0	0 0	0 1	0 0	0	0	3.28	0.01
2012 700	0 0	0 0	0 0	0 0	1 1	0	0	2.41	0.01
2013 700	0 0	0 0	0 0	0 0	0 1	0	1	2.75	0.00
TOTAL 6200	1 1	0 1	1 1	1 1	8 1	1			

HBAN: Ban Mai HDAI: Dai Thi HCUA: Cua Dat HSON: Son La

CQUA: Quan Ninh

Southern Region

TABLE 5.1.2 ADDITION UNITS AFTER INTERCONNE

NAME:	HDAI	NEW			LOLP	
		HOON		NEW+		
CAP.:	300	300			MAINT	NOMNT
YEAR CAP.	200		300		(DAYS/YEAR)	
1993 0	0 0	0	0	0	0.17	0.39
1994 0	0 0	0	0	0	0.00	0.00
1995 0	0 0	0	0	0	0.01	0.02
1996 0	0 0	0	0	0	3.01	0.12
1997 0	0 0	0	0	0	0.31	0.07
1998 0	0 0	0	0	0	1.12	0.10
1999 0	0 0	0	0	0	0.20	0.09
2000 0	0 0	0	0	0	0.04	0.01
2001 0	0 0	0	0	0	0.05	0.02
2002 0	0 0	0	0	0	0.92	0.16
2003 600	0 0	2	0		0.88	0.17
2004 300	0 0	1	0		1.54	0.30
2005 600	0 0	2	0		1.75	0.26
2006 300	0 0	1	0		2.42	0.38
2007 300	1 0	0	0		3.12	0.29
2008 500	0 1	1	0		3.44	0.32
2009 600	0 0	2	0		3.17	0.29
2010 900	0 0	1	2		2.48	0.14
2011 900	0 0	0	3		2.89	0.06
2012 1200	0 0	0	4		1.99	0.03
2013 900	0 0	0	3		2.64	0.03
TOTAL 7100	1 1	10	12			

HDAI: Dai Ninh HOON: Dong Nai4

NEW: New G.C/C NEW+: New Coal

Central Region

TABLE 5.1.3 ADDITION UNITS AFTER INTERCONNECTION OF CENTER

NAME:	HSE	HSE	HAN	HRAO		LOLP	
	HBUO	HPLI	HSON	HTHU			
CAP.:	220	366	116	80		MAINT	NOMNT
YEAR CAP.	81	120	60	260		(DAYS/YEAR)	
1993 0	0 0	0 0	0 0	0 0	0	36.52	36.51
1994 0	0 0	0 0	0 0	0 0	0	57.06	47.15
1995 0	0 0	0 0	0 0	0 0	0	0.0	0.0
1996 0	0 0	0 0	0 0	0 0	0	0.0	0.0
1997 0	0 0	0 0	0 0	0 0	0	1.56	1.57
1998 0	0 0	0 0	0 0	0 0	0	2.72	2.33
1999 0	0 0	0 0	0 0	0 0	0	1.45	0.35
2000 0	0 0	0 0	0 0	0 0	0	0.02	0.11
2001 120	0 0	0 1	0 0	0 0	0	2.07	0.18
2002 301	1 1	0 0	0 0	0 0	0	0.54	0.03
2003 0	0 0	0 0	0 0	0 0	0	5.30	0.09
2004 376	0 0	0 0	1 0	0 1	0	0.34	0.0
2005 60	0 0	0 0	0 1	0 0	0	1.00	0.01
2006 366	0 0	1 0	0 0	0 0	0	0.99	0.00
2007 80	0 0	0 0	0 0	1 0	0	0.79	0.01
2008 0	0 0	0 0	0 0	0 0	0	1.57	0.00
2009 0	0 0	0 0	0 0	0 0	0	1.63	0.00
2010 0	0 0	0 0	0 0	0 0	0	9.26	0.01
2011 0	0 0	0 0	0 0	0 0	0	0.98	0.01
2012 0	0 0	0 0	0 0	0 0	0	0.51	0.00
2013 0	0 0	0 0	0 0	0 0	0	1.07	0.00
TOTAL 1303	1 1	1 1	1 1	1 1	1		

HSE: Se San#3 HBUO: Buon Cuop HSE: SeSan#4 HPLI: Plei Krung

HAN: An Khe HSON: Son Con2 HRAO: Rao Quan HTHU: Thuong Kon Tum

Appendix Commissioning Year of Each Power Plant (Case-SS/GS) ④

Northern Region

TABLE 5.1.1 ADDITION UNITS AFTER INTERCONNECTION OF NORTH

NAME:	HBAN	HCUA	HSON	HSON	CQUA	HHOU							LOLP	
		HDAI	HSON	HSON	HSON	HHOU								
CAP.:	350	105	480	480	300	400							MAINT	NOMNT
YEAR	CAP.	250	480	480	480	400							(DAYS/YEAR)	
1993	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.23
1994	0	0	0	0	0	0	0	0	0	0	0	0	0.45	0.79
1995	0	0	0	0	0	0	0	0	0	0	0	0	0.76	1.70
1996	0	0	0	0	0	0	0	0	0	0	0	0	1.06	1.89
1997	0	0	0	0	0	0	0	0	0	0	0	0	1.62	1.95
1998	0	0	0	0	0	0	0	0	0	0	0	0	1.60	1.95
1999	0	0	0	0	0	0	0	0	0	0	0	0	0.96	1.25
2000	0	0	0	0	0	0	0	0	0	0	0	0	0.86	1.08
2001	0	0	0	0	0	0	0	0	0	0	0	0	1.16	1.50
2002	0	0	0	0	0	0	0	0	0	0	0	0	1.59	1.99
2003	0	0	0	0	0	0	0	0	0	0	0	0	1.67	1.89
2004	650	1	0	0	0	0	0	0	1	0	0		1.26	1.01
2005	0	0	0	0	0	0	0	0	0	0	0		2.91	1.49
2006	600	0	0	0	0	0	0	0	2	0	0		2.75	0.93
2007	1380	0	0	0	1	0	0	0	0	3	0	0	2.34	0.11
2008	480	0	0	0	0	1	0	0	0	0	0	0	1.50	0.07
2009	480	0	0	0	0	0	1	0	0	0	0	0	2.80	0.05
2010	780	0	0	0	0	0	0	1	0	1	0	0	2.98	0.02
2011	480	0	0	0	0	0	0	0	1	0	0	0	3.44	0.02
2012	650	0	1	0	0	0	0	0	0	0	1	0	3.47	0.01
2013	1300	0	0	0	0	0	0	0	0	3	0	1	3.12	0.00
TOTAL	6800	1	1	0	1	1	1	1	1	10	1	1		

HBAN: Ban Mai HDAI: Dai Thi HCUA: Cua Dat HSON: Son La

COUA: Quan Ninh

Southern Region

TABLE 5.1.2 ADDITION UNITS AFTER INTERCONNE

NAME:	HDAI	NEW			LOLP	
		HDON		NEW+		
CAP.:	300	300			MAINT	NOMNT
YEAR	CAP.	200		300	(DAYS/YEAR)	
1993	0	0	0	0	0.17	0.39
1994	0	0	0	0	0.00	0.00
1995	0	0	0	0	0.01	0.02
1996	0	0	0	0	3.01	0.12
1997	0	0	0	0	0.31	0.07
1998	0	0	0	0	1.12	0.10
1999	0	0	0	0	0.20	0.09
2000	0	0	0	0	0.04	0.01
2001	0	0	0	0	0.05	0.02
2002	0	0	0	0	0.84	0.11
2003	600	0	0	2	0.86	0.17
2004	300	0	0	1	0.84	0.16
2005	600	1	0	0	1.55	0.09
2006	200	0	1	0	2.37	0.16
2007	600	0	0	0	2	1.66	0.06
2008	600	0	0	0	2	1.41	0.05
2009	600	0	0	0	2	2.32	0.07
2010	900	0	0	0	3	2.54	0.04
2011	900	0	0	0	3	2.52	0.01
2012	900	0	0	0	3	2.86	0.03
2013	300	0	0	0	1	4.35	0.04
TOTAL	6500	1	1	3	17		

HDAI: Dai Ninh HDON: Dong Nai4

NEW: New G.C/C NEW+: New Coal

Central Region

TABLE 5.1.3 ADDITION UNITS AFTER INTERCONNECTION OF CENTER

NAME:	HSE	HSE	HAN	HRAO						LOLP	
	HBUO	HPLI	HSON	HTHU							
CAP.:	220	366	116	80						MAINT	NOMNT
YEAR	CAP.	81	120	60	260					(DAYS/YEAR)	
1993	0	0	0	0	0	0	0	0	0	36.52	36.51
1994	0	0	0	0	0	0	0	0	0	57.06	47.15
1995	0	0	0	0	0	0	0	0	0	0.0	0.0
1996	0	0	0	0	0	0	0	0	0	0.0	0.0
1997	0	0	0	0	0	0	0	0	0	1.56	1.57
1998	0	0	0	0	0	0	0	0	0	2.72	2.33
1999	0	0	0	0	0	0	0	0	0	1.45	0.35
2000	0	0	0	0	0	0	0	0	0	0.02	0.11
2001	120	0	0	1	0	0	0	0	0	2.07	0.18
2002	301	1	1	0	0	0	0	0	0	0.67	0.04
2003	0	0	0	0	0	0	0	0	0	2.35	0.10
2004	376	0	0	0	0	1	0	0	1	0.44	0.01
2005	60	0	0	0	0	0	1	0	0	1.40	0.02
2006	366	0	0	1	0	0	0	0	0	1.89	0.0
2007	80	0	0	0	0	0	0	1	0	1.82	0.0
2008	0	0	0	0	0	0	0	0	0	1.96	0.0
2009	0	0	0	0	0	0	0	0	0	4.45	0.01
2010	0	0	0	0	0	0	0	0	0	5.77	0.01
2011	0	0	0	0	0	0	0	0	0	1.08	0.00
2012	0	0	0	0	0	0	0	0	0	1.02	0.0
2013	0	0	0	0	0	0	0	0	0	2.63	0.02
TOTAL	1303	1	1	1	1	1	1	1	1		

HSE: Se San#3 HBUO: Buon Cuop HSE: SeSan#4 HPLI: Plei Krung

HAN: An Khe HSON: Son Con2 HRAO: Rao Quan HTHU: Thuong Kon Tum

Appendix Commissioning Year of Power Plant(Case-NS/GL) (01)

Northern Region

TABLE 5.1.1 ADDITION UNITS AFTER INTERCONNECTION OF NORTH

NAME:	HBAN	HCUA	HSON	HSON	CQUA	HHOU		LOLP	
	HDAI	HSON	HSON	HSON	HHOU				
CAP.:	350	105	480	480	300	400		MAINT	NOMNT
YEAR	CAP.	250	480	480	480	400		(DAYS/YEAR)	
1993	0	0 0	0 0	0 0	0 0	0 0	0	0.0	0.23
1994	0	0 0	0 0	0 0	0 0	0 0	0	0.45	0.79
1995	0	0 0	0 0	0 0	0 0	0 0	0	0.76	1.70
1996	0	0 0	0 0	0 0	0 0	0 0	0	1.07	1.90
1997	0	0 0	0 0	0 0	0 0	0 0	0	1.74	1.94
1998	0	0 0	0 0	0 0	0 0	0 0	0	1.60	1.93
1999	0	0 0	0 0	0 0	0 0	0 0	0	0.94	1.23
2000	0	0 0	0 0	0 0	0 0	0 0	0	0.74	1.08
2001	0	0 0	0 0	0 0	0 0	0 0	0	1.16	1.50
2002	0	0 0	0 0	0 0	0 0	0 0	0	1.36	1.90
2003	0	0 0	0 0	0 0	0 0	0 0	0	1.92	2.02
2004	650	1 0	0 0	0 0	1 0	0 0	0	1.65	0.99
2005	0	0 0	0 0	0 0	0 0	0 0	0	3.01	1.37
2006	600	0 0	0 0	0 0	2 0	0 0	0	2.33	0.86
2007	700	0 0	0 0	0 0	1 1	0 0	0	3.30	0.35
2008	700	0 0	0 0	0 0	1 0	1 0	1	2.36	0.19
2009	600	0 0	0 0	0 0	2 0	0 0	0	2.39	0.12
2010	900	0 0	0 0	0 0	3 0	0 0	0	1.63	0.05
2011	0	0 0	0 0	0 0	0 0	0 0	0	3.20	0.10
2012	600	0 0	0 0	0 0	2 0	0 0	0	3.56	0.10
2013	1005	0 0	1 0	0 0	3 0	0 0	0	3.34	0.05
TOTAL	5755	1 0	1 0	0 0	15 1	1			

Southern Region

TABLE 5.1.2 ADDITION UNITS AFTER INTERCONNE

NAME:	HDAI	NEW			LOLP	
		HDON	NEW+			
CAP.:	300	300			MAINT	NOMNT
YEAR	CAP.	200	300		(DAYS/YEAR)	
1993	0	0 0	0 0	0	0.17	0.39
1994	0	0 0	0 0	0	0.0	0.00
1995	0	0 0	0 0	0	0.00	0.02
1996	0	0 0	0 0	0	2.96	0.11
1997	0	0 0	0 0	0	0.29	0.07
1998	0	0 0	0 0	0	1.05	0.10
1999	0	0 0	0 0	0	0.21	0.09
2000	0	0 0	0 0	0	0.10	0.00
2001	0	0 0	0 0	0	0.05	0.02
2002	0	0 0	0 0	0	1.41	0.20
2003	600	1 0	1 0		1.27	0.07
2004	300	0 0	1 0		1.09	0.07
2005	600	0 0	2 0		1.31	0.10
2006	300	0 0	1 0		1.17	0.13
2007	500	0 1	1 0		2.27	0.21
2008	600	0 0	2 0		1.82	0.22
2009	600	0 0	2 0		1.74	0.12
2010	600	0 0	0 2		2.12	0.11
2011	900	0 0	0 3		2.58	0.08
2012	1200	0 0	0 4		2.14	0.03
2013	900	0 0	0 3		2.68	0.02
TOTAL	7100	1 1	10 12			

Central Region

TABLE 5.1.3 ADDITION UNITS AFTER INTERCONNECTION OF CENTER

NAME:	HSE	HSE	HAN	HRAO				LOLP	
		HBUO	HPLI	HSON	HTHU				
CAP.:	220	366	116	80				MAINT	NOMNT
YEAR	CAP.	81	120	60	260			(DAYS/YEAR)	
1993	0	0 0	0 0	0 0	0 0	0	0	36.52	36.51
1994	0	0 0	0 0	0 0	0 0	0	0	57.06	47.15
1995	0	0 0	0 0	0 0	0 0	0	0	0.0	0.0
1996	0	0 0	0 0	0 0	0 0	0	0	0.0	0.0
1997	0	0 0	0 0	0 0	0 0	0	0	1.56	1.57
1998	0	0 0	0 0	0 0	0 0	0	0	2.72	2.33
1999	0	0 0	0 0	0 0	0 0	0	0	1.75	0.39
2000	0	0 0	0 0	0 0	0 0	0	0	0.01	0.11
2001	120	0 0	0 1	0 0	0 0	0	0	2.01	0.18
2002	301	1 1	0 0	0 0	0 0	0	0	2.83	0.03
2003	0	0 0	0 0	0 0	0 0	0	0	5.69	0.08
2004	260	0 0	0 0	0 0	0 0	0	1	1.05	0.02
2005	176	0 0	0 0	1 1	0 0	0	0	3.07	0.00
2006	366	0 0	1 0	0 0	0 0	0	0	1.25	0.01
2007	0	0 0	0 0	0 0	0 0	0	0	0.90	0.01
2008	0	0 0	0 0	0 0	0 0	0	0	0.69	0.00
2009	80	0 0	0 0	0 0	1 0	0	0	2.44	0.01
2010	0	0 0	0 0	0 0	0 0	0	0	0.82	0.01
2011	0	0 0	0 0	0 0	0 0	0	0	0.79	0.00
2012	0	0 0	0 0	0 0	0 0	0	0	0.60	0.00
2013	0	0 0	0 0	0 0	0 0	0	0	1.33	0.00
TOTAL	1303	1 1	1 1	1 1	1 1	1	1		

Appendix Commissioning Year of Power Plant(Case-NS/GS) (02)

Northern Region

TABLE 5.1.1 ADDITION UNITS AFTER INTERCONNECTION OF NORTH

NAME:	HBAN		HCUA		HSON	HSON	HSON	CQUA	HHOU		LOLP	
		HDAI		HSON		HSON	HSON		HHOU			
CAP.:	350		105		480	480	480	300		400	MAINT	NOMNT
YEAR CAP.		250		480		480	480		400		(DAYS/YEAR)	
1993	0	0	0	0	0	0	0	0	0	0	0.0	0.23
1994	0	0	0	0	0	0	0	0	0	0	0.45	0.79
1995	0	0	0	0	0	0	0	0	0	0	0.76	1.70
1996	0	0	0	0	0	0	0	0	0	0	1.07	1.90
1997	0	0	0	0	0	0	0	0	0	0	1.74	1.94
1998	0	0	0	0	0	0	0	0	0	0	1.60	1.93
1999	0	0	0	0	0	0	0	0	0	0	0.94	1.23
2000	0	0	0	0	0	0	0	0	0	0	0.74	1.08
2001	0	0	0	0	0	0	0	0	0	0	1.16	1.50
2002	0	0	0	0	0	0	0	0	0	0	1.36	1.90
2003	0	0	0	0	0	0	0	0	0	0	1.85	2.01
2004	300	0	0	0	0	0	0	1	0	0	1.90	1.74
2005	600	0	0	0	0	0	0	2	0	0	1.86	1.09
2006	300	0	0	0	0	0	0	1	0	0	2.48	1.15
2007	750	1	0	0	0	0	0	0	1	0	2.58	0.37
2008	700	0	0	0	0	0	0	1	0	1	2.53	0.18
2009	900	0	0	0	0	0	0	3	0	0	2.07	0.09
2010	300	0	0	0	0	0	0	1	0	0	2.81	0.09
2011	600	0	0	0	0	0	0	2	0	0	1.80	0.06
2012	300	0	0	0	0	0	0	1	0	0	3.36	0.09
2013	1005	0	0	1	0	0	0	3	0	0	2.96	0.04
TOTAL	5755	1	0	1	0	0	0	15	1	1		

Southern Region

TABLE 5.1.2 ADDITION UNITS AFTER INTERCONNE

NAME:	HDAI		NEW			LOLP	
			HDON		NEW+		
CAP.:	300		300			MAINT	NOMNT
YEAR CAP.		200			300	(DAYS/YEAR)	
1993	0	0	0	0	0	0.17	0.39
1994	0	0	0	0	0	0.0	0.00
1995	0	0	0	0	0	0.00	0.02
1996	0	0	0	0	0	2.96	0.11
1997	0	0	0	0	0	0.29	0.07
1998	0	0	0	0	0	1.05	0.10
1999	0	0	0	0	0	0.21	0.09
2000	0	0	0	0	0	0.10	0.00
2001	0	0	0	0	0	0.05	0.02
2002	0	0	0	0	0	1.41	0.20
2003	600	1	0	1	0	1.07	0.06
2004	300	0	0	1	0	3.39	0.40
2005	300	0	0	1	0	1.67	0.16
2006	500	0	1	0	1	2.31	0.09
2007	600	0	0	0	2	2.66	0.16
2008	600	0	0	0	2	2.07	0.09
2009	600	0	0	0	2	2.03	0.06
2010	900	0	0	0	3	2.45	0.03
2011	900	0	0	0	3	1.72	0.02
2012	1200	0	0	0	4	2.13	0.01
2013	900	0	0	0	3	2.79	0.01
TOTAL	7400	1	1	3	20		

Central Region

TABLE 5.1.3 ADDITION UNITS AFTER INTERCONNECTION OF CENTER

NAME:	HSE		HSE		HAN		HRAO			LOLP	
		HBUO		HPLI		HSON		HTHU			
CAP.:	220		366		116		80			MAINT	NOMNT
YEAR CAP.		81		120		60		260		(DAYS/YEAR)	
1993	0	0	0	0	0	0	0	0	0	36.52	36.51
1994	0	0	0	0	0	0	0	0	0	57.06	47.15
1995	0	0	0	0	0	0	0	0	0	0.0	0.0
1996	0	0	0	0	0	0	0	0	0	0.0	0.0
1997	0	0	0	0	0	0	0	0	0	1.56	1.57
1998	0	0	0	0	0	0	0	0	0	2.72	2.33
1999	0	0	0	0	0	0	0	0	0	1.75	0.39
2000	0	0	0	0	0	0	0	0	0	0.01	0.11
2001	120	0	0	0	1	0	0	0	0	2.01	0.18
2002	301	1	1	0	0	0	0	0	0	2.83	0.03
2003	0	0	0	0	0	0	0	0	0	5.65	0.09
2004	260	0	0	0	0	0	0	0	1	0.85	0.01
2005	176	0	0	0	0	1	1	0	0	2.57	0.00
2006	366	0	0	1	0	0	0	0	0	1.03	0.00
2007	80	0	0	0	0	0	0	1	0	1.56	0.00
2008	0	0	0	0	0	0	0	0	0	2.55	0.0
2009	0	0	0	0	0	0	0	0	0	1.73	0.00
2010	0	0	0	0	0	0	0	0	0	7.98	0.01
2011	0	0	0	0	0	0	0	0	0	0.39	0.00
2012	0	0	0	0	0	0	0	0	0	0.57	0.00
2013	0	0	0	0	0	0	0	0	0	1.37	0.01
TOTAL	1303	1	1	1	1	1	1	1	1		

Appendix Commissioning Year of Each Power Plant (Case-SL/GS) DM: High Case (6)

Northern Region

TABLE 5.1.1 ADDITION UNITS AFTER INTERCONNECTION OF NORTH

NAME:	HBAN	HCUA	HSON	HSON	HSON						LOLP	
		HDAI	HSON	HSON	HSON	CQUA						
CAP.:	350	105	600	600	600						MAINT	NOMNT
YEAR CAP.		250	600	600	600	300					(DAYS/YEAR)	
1993	0	0	0	0	0	0	0	0	0	0	0.0	0.23
1994	0	0	0	0	0	0	0	0	0	0	0.46	0.80
1995	0	0	0	0	0	0	0	0	0	0	0.97	1.76
1996	0	0	0	0	0	0	0	0	0	0	1.56	1.93
1997	0	0	0	0	0	0	0	0	0	0	1.70	1.59
1998	0	0	0	0	0	0	0	0	0	0	1.77	1.99
1999	0	0	0	0	0	0	0	0	0	0	1.28	1.57
2000	0	0	0	0	0	0	0	0	0	0	1.02	1.16
2001	0	0	0	0	0	0	0	0	0	0	1.24	1.58
2002	0	0	0	0	0	0	0	0	0	0	1.37	1.83
2003	0	0	0	0	0	0	0	0	0	0	2.62	2.23
2004	600	0	0	0	0	0	0	0	0	2	2.63	1.55
2005	300	0	0	0	0	0	0	0	0	1	2.69	1.49
2006	300	0	0	0	0	0	0	0	0	1	2.91	1.49
2007	1250	1	0	0	1	0	0	0	0	1	3.17	0.22
2008	600	0	0	0	0	1	0	0	0	0	2.21	0.19
2009	900	0	0	0	0	0	1	0	0	1	2.68	0.07
2010	850	0	1	0	0	0	0	1	0	0	3.42	0.02
2011	1005	0	0	1	0	0	0	0	1	0	4.08	0.00
2012	900	0	0	0	0	0	0	0	0	1	3.00	0.01
2013	1200	0	0	0	0	0	0	0	0	0	3.09	0.00
TOTAL	7905	1	1	1	1	1	1	1	1	1	12	

HBAN: Ban Mai HDAI: Dai Thi HCUA: Cua Dat HSON: Son La

CQUA: Quan Ninh

Southern Region

TABLE 5.1.2 ADDITION UNITS AFTER INTERCONNE

NAME:	HDAI	NEW			LOLP	
	HDON	NEW+				
CAP.:	300	300			MAINT	NOMNT
YEAR CAP.	200	300			(DAYS/YEAR)	
1993	0	0	0	0	0.17	0.39
1994	0	0	0	0	0.0	0.0
1995	0	0	0	0	0.28	0.03
1996	0	0	0	0	0.12	0.14
1997	0	0	0	0	0.63	0.13
1998	0	0	0	0	0.49	0.18
1999	0	0	0	0	0.30	0.11
2000	0	0	0	0	0.05	0.01
2001	0	0	0	0	0.39	0.09
2002	300	0	0	1	0.79	0.09
2003	600	0	0	2	0.82	0.15
2004	0	0	0	0	2.71	0.20
2005	900	1	0	0	1.76	0.11
2006	500	0	1	0	1.97	0.08
2007	600	0	0	0	2.51	0.03
2008	600	0	0	0	1.90	0.02
2009	600	0	0	0	3.14	0.03
2010	900	0	0	0	3.87	0.06
2011	900	0	0	0	3.99	0.03
2012	1200	0	0	0	3.69	0.02
2013	900	0	0	0	5.59	0.02
TOTAL	8000	1	1	3	22	

HDAI: Dai Ninh HDON: Dong Nai4

NEW: New G.C/C NEW+: New Coal

Central Region

TABLE 5.1.3 ADDITION UNITS AFTER INTERCONNECTION OF CENTER

NAME:	HSE	HSE	HAN	HRAO						LOLP	
	HBUO	HPLI	HSON	HTHU							
CAP.:	220	366	116	80						MAINT	NOMNT
YEAR CAP.	81	120	60	260						(DAYS/YEAR)	
1993	0	0	0	0	0	0	0	0	0	36.52	36.51
1994	0	0	0	0	0	0	0	0	0	58.76	48.54
1995	0	0	0	0	0	0	0	0	0	0.0	0.0
1996	0	0	0	0	0	0	0	0	0	0.0	0.0
1997	0	0	0	0	0	0	0	0	0	1.76	1.64
1998	0	0	0	0	0	0	0	0	0	3.06	2.65
1999	0	0	0	0	0	0	0	0	0	0.79	0.27
2000	0	0	0	0	0	0	0	0	0	0.03	0.13
2001	120	0	0	0	1	0	0	0	0	0.98	0.16
2002	301	1	1	0	0	0	0	0	0	6.71	0.14
2003	0	0	0	0	0	0	0	0	0	6.25	0.07
2004	376	0	0	0	0	1	0	0	1	5.61	0.06
2005	60	0	0	0	0	0	1	0	0	5.72	0.01
2006	366	0	0	1	0	0	0	0	0	4.77	0.0
2007	80	0	0	0	0	0	0	1	0	1.89	0.0
2008	0	0	0	0	0	0	0	0	0	8.32	0.02
2009	0	0	0	0	0	0	0	0	0	8.67	0.01
2010	0	0	0	0	0	0	0	0	0	17.87	0.01
2011	0	0	0	0	0	0	0	0	0	1.79	0.00
2012	0	0	0	0	0	0	0	0	0	1.64	0.01
2013	0	0	0	0	0	0	0	0	0	13.88	0.01
TOTAL	1303	1	1	1	1	1	1	1	1		

HSE: Se San#3 HBUO: Buon Cuop HSE: SeSan#4 HPLI: Plei Krung

HAN: An Khe HSON: Son Con2 HRAO: Rao Quan HTHU: Thuong Kon Tum

Appendix Commissioning Year of Each Power Plant (Case-SS/GS) DM: High Case (8)

Northern Region

TABLE 5.1.1 ADDITION UNITS AFTER INTERCONNECTION OF NORTH

NAME:	HBAN		HCUA	HSON	HSON	HSON	CQUA	HHOU		LOLP	
		HDAI		HSON	HSON	HSON		HHOU			
CAP.:	350		105	480		480	300		400	MAINT	NOMNT
YEAR CAP.		250		480	480	480		400		(DAYS/YEAR)	
1993	0	0	0	0	0	0	0	0	0	0.0	0.23
1994	0	0	0	0	0	0	0	0	0	0.46	0.80
1995	0	0	0	0	0	0	0	0	0	0.97	1.76
1996	0	0	0	0	0	0	0	0	0	1.56	1.93
1997	0	0	0	0	0	0	0	0	0	1.70	1.59
1998	0	0	0	0	0	0	0	0	0	1.77	1.99
1999	0	0	0	0	0	0	0	0	0	1.28	1.57
2000	0	0	0	0	0	0	0	0	0	1.02	1.16
2001	0	0	0	0	0	0	0	0	0	1.11	1.30
2002	0	0	0	0	0	0	0	0	0	1.46	1.93
2003	0	0	0	0	0	0	0	0	0	2.27	2.13
2004	300	0	0	0	0	0	0	0	0	3.24	2.46
2005	600	0	0	0	0	0	0	0	0	3.02	1.81
2006	550	0	1	0	0	0	0	0	0	2.60	1.03
2007	1130	1	0	0	1	0	0	0	0	3.41	0.16
2008	780	0	0	0	0	1	0	0	0	2.19	0.10
2009	1080	0	0	0	0	0	1	0	0	3.33	0.02
2010	585	0	0	1	0	0	0	1	0	3.38	0.01
2011	1080	0	0	0	0	0	0	0	1	3.40	0.00
2012	700	0	0	0	0	0	0	0	0	2.50	0.01
2013	700	0	0	0	0	0	0	0	0	3.05	0.01
TOTAL	7505	1	1	1	1	1	1	1	1	12	1	1

HBAN: Ban Mai HDAI: Dai Thi HCUA: Cua Dat HSON: Son La

CQUA: Quan Ninh

Southern Region

TABLE 5.1.2 ADDITION UNITS AFTER INTERCONNE

NAME:	HDAI		NEW		NEW+	LOLP	
			HDON				
CAP.:	300		300			MAINT	NOMNT
YEAR CAP.		200		300		(DAYS/YEAR)	
1993	0	0	0	0	0	0.17	0.39
1994	0	0	0	0	0	0.0	0.0
1995	0	0	0	0	0	0.28	0.03
1996	0	0	0	0	0	0.12	0.14
1997	0	0	0	0	0	0.63	0.13
1998	0	0	0	0	0	0.49	0.18
1999	0	0	0	0	0	0.30	0.11
2000	0	0	0	0	0	0.04	0.01
2001	0	0	0	0	0	0.32	0.08
2002	300	0	0	1	0	0.97	0.12
2003	600	0	0	2	0	0.87	0.19
2004	300	1	0	0	0	2.58	0.23
2005	300	0	0	0	1	2.91	0.17
2006	800	0	1	0	2	2.11	0.08
2007	600	0	0	0	2	2.33	0.05
2008	600	0	0	0	2	2.30	0.06
2009	300	0	0	0	1	4.31	0.18
2010	1200	0	0	0	4	3.72	0.07
2011	900	0	0	0	3	3.97	0.03
2012	1200	0	0	0	4	3.82	0.02
2013	900	0	0	0	3	5.96	0.0
TOTAL	8000	1	1	3	22		

HDAI: Dai Ninh HDON: Dong Nai4

NEW: New G.C/C NEW+: New Coal

Central Region

TABLE 5.1.3 ADDITION UNITS AFTER INTERCONNECTION OF CENTER

NAME:	HSE		HSE		HAN		HRAO		LOLP	
		HBUO		HPLI		HSON		HTHU		
CAP.:	220		366		116		80		MAINT	NOMNT
YEAR CAP.		81		120		60		260	(DAYS/YEAR)	
1993	0	0	0	0	0	0	0	0	36.52	36.51
1994	0	0	0	0	0	0	0	0	58.76	48.54
1995	0	0	0	0	0	0	0	0	0.0	0.0
1996	0	0	0	0	0	0	0	0	0.0	0.0
1997	0	0	0	0	0	0	0	0	1.76	1.64
1998	0	0	0	0	0	0	0	0	3.06	2.65
1999	0	0	0	0	0	0	0	0	0.79	0.27
2000	0	0	0	0	0	0	0	0	1.50	0.13
2001	120	0	0	0	1	0	0	0	1.48	0.15
2002	301	1	1	0	0	0	0	0	6.55	0.03
2003	0	0	0	0	0	0	0	0	3.01	0.05
2004	376	0	0	0	0	1	0	1	0.88	0.00
2005	60	0	0	0	0	1	0	0	9.46	0.01
2006	366	0	0	1	0	0	0	0	0.40	0.01
2007	0	0	0	0	0	0	0	0	2.37	0.01
2008	80	0	0	0	0	0	0	1	3.37	0.01
2009	0	0	0	0	0	0	0	0	13.70	0.01
2010	0	0	0	0	0	0	0	0	16.79	0.01
2011	0	0	0	0	0	0	0	0	1.67	0.00
2012	0	0	0	0	0	0	0	0	2.16	0.0
2013	0	0	0	0	0	0	0	0	14.32	0.07
TOTAL	1303	1	1	1	1	1	1	1	1	

HSE: Se San#3 HBUO: Buon Cuop HSE: SeSan#4 HPLI: Plei Krung

HAN: An Khe HSON: Son Con2 HRAO: Rao Quan HTHU: Thuong Kon Tum

Northern Region

TABLE 5.1.1 ADDITION UNITS AFTER INTERCONNECTION OF NORTH

NAME:		HBAN	HCUA	HSON	HSON	HSON	HSON			LOLP	
		HDAI	HSON	HSON	HSON	HSON	CQUA				
CAP.:	350	105	600	600	600	600				MAINT	NOMNT
YEAR	CAP.	250	600	600	600	300				(DAYS/YEAR)	
1993	0	0	0	0	0	0	0	0	0	0.0	0.23
1994	0	0	0	0	0	0	0	0	0	0.45	0.79
1995	0	0	0	0	0	0	0	0	0	0.76	1.70
1996	0	0	0	0	0	0	0	0	0	1.06	1.89
1997	0	0	0	0	0	0	0	0	0	1.62	1.95
1998	0	0	0	0	0	0	0	0	0	1.60	1.95
1999	0	0	0	0	0	0	0	0	0	0.96	1.25
2000	0	0	0	0	0	0	0	0	0	0.89	1.08
2001	0	0	0	0	0	0	0	0	0	1.21	1.45
2002	0	0	0	0	0	0	0	0	0	1.86	1.96
2003	0	0	0	0	0	0	0	0	0	2.03	2.07
2004	600	0	0	0	0	0	0	0	2	1.95	1.34
2005	0	0	0	0	0	0	0	0	0	2.67	1.70
2006	550	0	1	0	0	0	0	0	1	2.91	1.13
2007	600	0	0	0	0	0	0	0	2	2.62	0.75
2008	600	0	0	0	0	0	0	0	2	3.37	0.70
2009	950	1	0	0	1	0	0	0	0	2.92	0.15
2010	600	0	0	0	0	1	0	0	0	2.26	0.06
2011	600	0	0	0	0	0	1	0	0	2.29	0.03
2012	900	0	0	0	0	0	0	1	0	2.54	0.02
2013	1305	0	0	1	0	0	0	0	1	3.36	0.01
TOTAL	6705	1	1	1	1	1	1	1	0	10	

HBAN: Ban Mai HDAI: Dai Thi HCUA: Cua Dat HSON: Son La

CQUA: Quan Ninh

Southern Region

TABLE 5.1.2 ADDITION UNITS AFTER INTERCONNE

NAME:		HDAI	NEW			LOLP	
		HDON	NEW+				
CAP.:	300	300				MAINT	NOMNT
YEAR	CAP.	200	300			(DAYS/YEAR)	
1993	0	0	0	0	0	0.17	0.39
1994	0	0	0	0	0	0.00	0.00
1995	0	0	0	0	0	0.01	0.02
1996	0	0	0	0	0	3.01	0.12
1997	0	0	0	0	0	0.31	0.07
1998	0	0	0	0	0	1.12	0.10
1999	0	0	0	0	0	0.20	0.09
2000	0	0	0	0	0	0.03	0.01
2001	0	0	0	0	0	0.09	0.03
2002	0	0	0	0	0	1.21	0.13
2003	600	0	0	2	0	0.74	0.12
2004	0	0	0	0	0	1.81	0.34
2005	900	1	0	1	1	1.59	0.11
2006	200	0	1	0	0	2.10	0.17
2007	600	0	0	0	2	1.92	0.10
2008	600	0	0	0	2	2.52	0.05
2009	900	0	0	0	3	1.93	0.00
2010	600	0	0	0	2	1.88	0.03
2011	900	0	0	0	3	1.83	0.02
2012	900	0	0	0	3	2.29	0.01
2013	300	0	0	0	1	4.73	0.03
TOTAL	6500	1	1	3	17		

HDAI: Dai Ninh HDON: Dong Nai4

NEW: New G.C/C NEW+: New Coal

Central Region

TABLE 5.1.3 ADDITION UNITS AFTER INTERCONNECTION OF CENTER

NAME:		HSE	HSE	HAN	HRAO			LOLP	
		HBUO	HPLI	HSON	HTHU				
CAP.:	220	366	116	80				MAINT	NOMNT
YEAR	CAP.	81	120	60	260			(DAYS/YEAR)	
1993	0	0	0	0	0	0	0	36.52	36.51
1994	0	0	0	0	0	0	0	57.06	47.15
1995	0	0	0	0	0	0	0	0.0	0.0
1996	0	0	0	0	0	0	0	0.0	0.0
1997	0	0	0	0	0	0	0	1.56	1.57
1998	0	0	0	0	0	0	0	2.72	2.33
1999	0	0	0	0	0	0	0	1.45	0.35
2000	0	0	0	0	0	0	0	0.01	0.11
2001	120	0	0	1	0	0	0	2.15	0.17
2002	301	1	1	0	0	0	0	0.02	0.04
2003	0	0	0	0	0	0	0	2.92	0.10
2004	260	0	0	0	0	0	1	0.03	0.01
2005	176	0	0	0	1	1	0	6.24	0.01
2006	366	0	0	1	0	0	0	4.89	0.01
2007	80	0	0	0	0	1	0	0.88	0.0
2008	0	0	0	0	0	0	0	8.21	0.00
2009	0	0	0	0	0	0	0	6.13	0.00
2010	0	0	0	0	0	0	0	6.86	0.01
2011	0	0	0	0	0	0	0	0.56	0.01
2012	0	0	0	0	0	0	0	1.39	0.00
2013	0	0	0	0	0	0	0	3.78	0.01
TOTAL	1303	1	1	1	1	1	1	1	

HSE: Se San#3 HBUO: Buon Cuop HSE: SeSan#4 HPLI: Plei Krung

HAN: An Khe HSON: Son Con2 HRAO: Rao Quan HTHU: Thuong Kon Tum

Appendix Commissioning Year of Each Power Plant (Case-SS/GS) SonLa(S) 2yr.-Delayed ⑩

Northern Region

TABLE 5.1.1 ADDITION UNITS AFTER INTERCONNECTION OF NORTH

NAME:	HBAN	HCUA	HSON	HSON	CQUA	HHOU	LOLP	
	HDAI	HSON	HSON	HSON	HHOU			
CAP.:	350	105	480	480	300	400	MAINT	NOMNT
YEAR CAP.	250	480	480	480	400		(DAYS/YEAR)	
1993	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0.0	0.23
1994	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0.45	0.79
1995	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0.76	1.70
1996	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	1.06	1.89
1997	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	1.62	1.95
1998	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	1.60	1.95
1999	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0.96	1.25
2000	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0.86	1.08
2001	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	1.16	1.50
2002	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	1.59	1.99
2003	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	1.67	1.89
2004	600 0 0	0 0 0	0 0 0	0 0 0	2 0 0	0 0 0	1.38	1.28
2005	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	0 0 0	2.78	1.92
2006	550 0 1	0 0 0	0 0 0	0 0 0	1 0 0	0 0 0	3.07	1.39
2007	600 0 0	0 0 0	0 0 0	0 0 0	2 0 0	0 0 0	2.62	0.72
2008	600 0 0	0 0 0	0 0 0	0 0 0	2 0 0	0 0 0	3.21	0.66
2009	1130 1 0	0 1 0	0 0 0	0 0 0	1 0 0	0 0 0	2.58	0.15
2010	480 0 0	0 0 1	0 0 0	0 0 0	0 0 0	0 0 0	2.59	0.06
2011	480 0 0	0 0 0	1 0 0	0 0 0	0 0 0	0 0 0	3.44	0.05
2012	1080 0 0	0 0 0	0 0 1	0 0 0	2 0 0	0 0 0	2.68	0.01
2013	1485 0 0	1 0 0	0 0 0	0 0 1	3 0 0	0 0 0	3.02	0.00
TOTAL	7005 1 1	1 1 1	1 1 1	1 1 1	13 0 0			

HSE: Se San#3 HBUO: Buon Cuop HSE: SeSan#4 HPLI: Plei Krung

HAN: An Khe HSON: Son Con2 HRAO: Rao Quan HTHU: Thuong Kon Tum

Southern Region

TABLE 5.1.2 ADDITION UNITS AFTER INTERCONNE

NAME:	HDAI	NEW			LOLP	
		HDON	NEW+			
CAP.:	300	300			MAINT	NOMNT
YEAR CAP.	200	300			(DAYS/YEAR)	
1993	0 0 0	0 0			0.17	0.39
1994	0 0 0	0 0			0.00	0.00
1995	0 0 0	0 0			0.01	0.02
1996	0 0 0	0 0			3.01	0.12
1997	0 0 0	0 0			0.31	0.07
1998	0 0 0	0 0			1.12	0.10
1999	0 0 0	0 0			0.20	0.09
2000	0 0 0	0 0			0.04	0.01
2001	0 0 0	0 0			0.05	0.02
2002	0 0 0	0 0			0.84	0.11
2003	600 0 0	2 0			0.86	0.17
2004	300 0 0	1 0			0.77	0.16
2005	600 1 0	0 1			1.66	0.09
2006	200 0 1	0 0			2.71	0.22
2007	600 0 0	0 2			1.59	0.10
2008	600 0 0	0 2			2.57	0.06
2009	600 0 0	0 2			1.94	0.02
2010	900 0 0	0 3			2.27	0.05
2011	900 0 0	0 3			2.85	0.02
2012	900 0 0	0 3			2.38	0.01
2013	300 0 0	0 1			4.30	0.03
TOTAL	6500 1 1	3 17				

HDAI: Dai Ninh HDON: Dong Nai4

NEW: New G.C/C NEW+: New Coal

Central Region

TABLE 5.1.3 ADDITION UNITS AFTER INTERCONNECTION OF CENTER

NAME:	HSE	HSE	HAN	HRAO		LOLP	
	HBUO	HPLI	HSON	HTHU			
CAP.:	220	366	116	80		MAINT	NOMNT
YEAR CAP.	81	120	60	260		(DAYS/YEAR)	
1993	0 0 0	0 0 0	0 0 0	0 0 0		36.52	36.51
1994	0 0 0	0 0 0	0 0 0	0 0 0		57.06	47.15
1995	0 0 0	0 0 0	0 0 0	0 0 0		0.0	0.0
1996	0 0 0	0 0 0	0 0 0	0 0 0		0.0	0.0
1997	0 0 0	0 0 0	0 0 0	0 0 0		1.56	1.57
1998	0 0 0	0 0 0	0 0 0	0 0 0		2.72	2.33
1999	0 0 0	0 0 0	0 0 0	0 0 0		1.45	0.35
2000	0 0 0	0 0 0	0 0 0	0 0 0		0.02	0.11
2001	120 0 0	0 1 0	0 0 0	0 0 0		2.07	0.18
2002	301 1 1	0 0 0	0 0 0	0 0 0		0.67	0.04
2003	0 0 0	0 0 0	0 0 0	0 0 0		2.35	0.10
2004	376 0 0	0 0 1	0 0 0	1 0 0		0.48	0.01
2005	60 0 0	0 0 0	0 1 0	0 0 0		1.78	0.02
2006	366 0 0	1 0 0	0 0 0	0 0 0		1.22	0.00
2007	80 0 0	0 0 0	0 0 1	0 0		0.0	0.01
2008	0 0 0	0 0 0	0 0 0	0 0 0		4.32	0.0
2009	0 0 0	0 0 0	0 0 0	0 0 0		4.67	0.01
2010	0 0 0	0 0 0	0 0 0	0 0 0		3.41	0.01
2011	0 0 0	0 0 0	0 0 0	0 0 0		1.24	0.01
2012	0 0 0	0 0 0	0 0 0	0 0 0		1.63	0.02
2013	0 0 0	0 0 0	0 0 0	0 0 0		2.37	0.01
TOTAL	1303 1 1	1 1 1	1 1 1	1 1 1			

HBAN: Ban Mai HDAI: Dai Thi HCUA: Cua Dat HSON: Son La

CQUA: Quan Ninh

Appendix Commissioning Year of Each Power Plant (Case-SS/GS) LOLP=3.0% (11)

Northern Region

TABLE 5.1.1 ADDITION UNITS AFTER INTERCONNECTION OF NORTH

NAME:	HBAN		HCUA		HSON		HSON		CQUA		HHOU		LOLP	
		HDAI		HSON		HSON		HSON		HHOU				
CAP.:	350		105		480		480		300		400		MAINT	NOMNT
YEAR	CAP.		250		480		480		480		400		(DAYS/YEAR)	
1993	0	0	0	0	0	0	0	0	0	0	0	0	0.0	0.23
1994	0	0	0	0	0	0	0	0	0	0	0	0	0.44	0.79
1995	0	0	0	0	0	0	0	0	0	0	0	0	0.74	1.70
1996	0	0	0	0	0	0	0	0	0	0	0	0	1.03	1.49
1997	0	0	0	0	0	0	0	0	0	0	0	0	1.75	2.20
1998	0	0	0	0	0	0	0	0	0	0	0	0	1.77	2.29
1999	0	0	0	0	0	0	0	0	0	0	0	0	1.07	1.37
2000	0	0	0	0	0	0	0	0	0	0	0	0	0.89	1.12
2001	0	0	0	0	0	0	0	0	0	0	0	0	1.29	1.60
2002	0	0	0	0	0	0	0	0	0	0	0	0	2.22	2.39
2003	0	0	0	0	0	0	0	0	0	0	0	0	4.77	3.56
2004	0	0	0	0	0	0	0	0	0	0	0	0	8.90	5.82
2005	300	0	0	0	0	0	0	0	0	1	0	0	9.77	6.84
2006	600	0	0	0	0	0	0	0	0	2	0	0	6.23	3.99
2007	780	0	0	0	1	0	0	0	0	1	0	0	9.46	1.61
2008	830	1	0	0	0	1	0	0	0	0	0	0	8.57	0.35
2009	780	0	0	0	0	0	1	0	0	1	0	0	6.02	0.11
2010	780	0	0	0	0	0	0	1	0	1	0	0	9.22	0.06
2011	480	0	0	0	0	0	0	0	1	0	0	0	8.71	0.04
2012	700	0	0	0	0	0	0	0	0	1	1	0	7.51	0.03
2013	1000	0	0	0	0	0	0	0	0	2	0	1	8.73	0.01
TOTAL	6250	1	0	0	1	1	1	1	1	9	1	1		

HBAN: Ban Mai HDAI: Dai Thi HCUA: Cua Dat HSON: Son La

CQUA: Quan Ninh

Southern Region

TABLE 5.1.2 ADDITION UNITS AFTER INTERCONNE(

NAME:	HDAI		NEW		NEW+		LOLP	
			HDON					
CAP.:	300		300				MAINT	NOMNT
YEAR	CAP.		200		300		(DAYS/YEAR)	
1993	0	0	0	0	0	0	0.17	0.39
1994	0	0	0	0	0	0	0.00	0.00
1995	0	0	0	0	0	0	0.00	0.06
1996	0	0	0	0	0	0	0.40	0.10
1997	0	0	0	0	0	0	0.40	0.09
1998	0	0	0	0	0	0	0.66	0.07
1999	0	0	0	0	0	0	0.19	0.09
2000	0	0	0	0	0	0	0.02	0.0
2001	0	0	0	0	0	0	0.14	0.04
2002	0	0	0	0	0	0	0.93	0.13
2003	0	0	0	0	0	0	6.25	1.64
2004	600	0	0	2	0	0	5.99	1.41
2005	300	0	0	1	0	0	6.32	0.93
2006	600	1	0	0	1	0	8.15	0.34
2007	600	0	0	0	2	0	3.62	0.30
2008	300	0	0	0	1	0	9.49	1.22
2009	800	0	1	0	2	0	5.21	0.33
2010	600	0	0	0	2	0	7.18	0.26
2011	900	0	0	0	3	0	6.57	0.09
2012	900	0	0	0	3	0	7.00	0.10
2013	600	0	0	0	2	0	8.98	0.09
TOTAL	6200	1	1	3	16			

HDAI: Dai Ninh HDON: Dong Nai4

NEW: New G.C/C NEW+: New Coal

Central Region

TABLE 5.1.3 ADDITION UNITS AFTER INTERCONNECTION OF CENTER

NAME:	HSE		HSE		HAN		HRAO				LOLP	
		HBUO		HPLI		HSON		HTHU				
CAP.:	220		366		116		80				MAINT	NOMNT
YEAR	CAP.		81		120		60		260		(DAYS/YEAR)	
1993	0	0	0	0	0	0	0	0	0	0	36.52	36.51
1994	0	0	0	0	0	0	0	0	0	0	57.06	47.15
1995	0	0	0	0	0	0	0	0	0	0	0.0	0.0
1996	0	0	0	0	0	0	0	0	0	0	0.0	0.0
1997	0	0	0	0	0	0	0	0	0	0	1.56	1.58
1998	0	0	0	0	0	0	0	0	0	0	2.73	2.33
1999	0	0	0	0	0	0	0	0	0	0	0.37	0.40
2000	0	0	0	0	0	0	0	0	0	0	0.45	0.12
2001	120	0	0	0	1	0	0	0	0	0	3.23	0.16
2002	220	1	0	0	0	0	0	0	0	0	1.11	0.11
2003	81	0	1	0	0	0	0	0	0	0	10.49	0.12
2004	0	0	0	0	0	0	0	0	0	0	8.33	0.11
2005	436	0	0	0	0	1	1	0	1	0	5.07	0.03
2006	366	0	0	1	0	0	0	0	0	0	0.63	0.00
2007	0	0	0	0	0	0	0	0	0	0	2.29	0.01
2008	0	0	0	0	0	0	0	0	0	0	2.22	0.00
2009	80	0	0	0	0	0	0	1	0	0	9.29	0.02
2010	0	0	0	0	0	0	0	0	0	0	17.59	0.04
2011	0	0	0	0	0	0	0	0	0	0	3.97	0.01
2012	0	0	0	0	0	0	0	0	0	0	3.68	0.03
2013	0	0	0	0	0	0	0	0	0	0	11.54	0.14
TOTAL	1303	1	1	1	1	1	1	1	1	1		

HSE: Se San#3 HBUO: Buon Cuop HSE: SeSan#4 HPLI: Plei Krung

HAN: An Khe HSON: Son Con2 HRAO: Rao Quan HTHU: Thuong Kon Tum

Summary of The PDP Case Study

Demand: Base Hydro Cond. : Normal (P=50%)

Case / Item	Case-① SL/GL North	South	Center	Gr. Total cost (M$)	Case-② SL/GS North	South	Center	Gr. Total cost (M$)
Total M$	4,931	8,155	1,649	14,735	5,060	8,293	1,635	14,988
Capital	3,886	3,617	1,507	9,010	4,010	3,867	1,492	9,369
Fuel w/o	372	1,314	86	1,772	349	1,285	86	1,720
O & M	223	453	16	692	215	459	16	690
Variable T.P.Repl	389 61	2,581 190	40 —	3,010 251	421 65	2,506 176	41 —	2,968 241
LOLP D/y	1.84	1.54	6.91	3.43day	1.95	1.49	6.37	3.27day
EUE (GWh)	168.4	105.0	253.3	527GWh	179.9	100.1	220.1	500GWh

Case / Item	Case-③ SS/GL North	South	Center	Gr. Total cost (M$)	Case-④ SS/GS North	South	Center	Gr. Total cost (M$)
Total M$	4,534	8,191	1,637	14,362	4,791	8,290	1,644	14,725
Capital	3,172	3,640	1,507	8,326	3,347	3,883	1,507	8,737
Fuel	422	1,316	86	1,824	436	1,276	86	1,798
O & M	249	456	16	721	259	456	16	731
Variable T.P.Repl	617 74	2,581 191	28 —	3,226 265	661 88	2,499 176	35 —	3,195 264
LOLP D/y	1.85	1.53	5.97	3.12day	1.82	1.38	6.04	3.08day
EUE (GWh)	167.7	104.4	220.3	493GWh	165.5	93.8	208.1	467GWh

Without Son La

Case / Item	Case-01 NS/GL North	South	Center	Gr. Total cost (M$)	Case-02 NS/GS North	South	Center	Gr. Total cost (M$)
Total M$	5,166	8,178	1,638	14,982	5,203	8,578	1,649	15,430
Capital	2,902	3,706	1,487	8,095	2,900	4,130	1,497	8,527
Fuel	553	1,276	87	1,916	575	1,265	88	1,928
O & M	310	444	16	770	322	453	16	791
Variable T.P.Repl	1,281 120	2,562 190	48 —	3,891 310	1,283 123	2,542 188	48 —	3,873 311
LOLP D/y	1.83	1.26	5.86	2.99day	1.72	1.45	6.22	3.13day
EUE (GWh)	177.4	82.5	201.5	461GWh	174.4	92.3	211.5	478GWh

Price Order: SS/GL < SS/GS < SL/GL < SL/GS ≒ NS/GL < NS/GS

Demand: High

Case / Item	Case-⑤ SL/GL North	South	Center	Gr. Total cost(M$)	Case-⑥ SL/GS North	South	Center	Gr. Total cost(M$)
Total M$	5,770	9,607	1,648	17,025	5,871	9,736	1,671	17,278
Capital	4,411	4,184	1,507	10,102	4,410	4,470	1,507	10,387
Fuel	411	1,560	90	2,061	468	1,495	94	2,057
O & M	245	539	17	801	274	529	17	820
Variable	611	3,086	34	3,731	619	3,024	53	3,696
T.P.Repl	92	238	—	330	100	218	—	318
LOLP D/y	1.93	1.35	6.56	3.28day	2.09	1.69	8.81	4.19day
EUE(GWh)	175.2	108.4	233.5	517GWh	197.6	132.8	399.4	730GWh

Case / Item	Case-⑦ SS/GL North	South	Center	Gr. Total cost(M$)	Case-⑧ SS/GS North	South	Center	Gr. Total cost(M$)
Total M$	5,290	9,584	1,651	16,525	5,405	9,715	1,670	16,790
Capital	3,614	4,181	1,507	9,302	3,695	4,464	1,500	9,659
Fuel	469	1,551	91	2,111	499	1,497	96	2,092
O & M	276	535	17	828	292	527	17	836
Variable	830	3,082	36	3,948	812	3,018	57	3,887
T.P.Repl	101	235	—	336	107	209	—	316
LOLP D/y	1.95	1.47	6.68	3.37day	2.08	1.82	8.50	4.13day
EUE(GWh)	174.3	105.7	244.5	525GWh	191.7	138.8	395.2	726GWh

All costs are discounted value in million US$ and include IDC.
Fuel and O&M cost are total discounted value from 1993 through 2013.
Capital cost is total value of all power plants from 1996 through 2013.

Variavble : Variable cost from 2014 through 2060
T.P.Repl : Cost of Thermal Plant Replacement from 2014 through 2060

Delayed Son La 2 years

Case / Item	Case-⑨ DSL/GS North	South	Center	Gr. Total cost(M$)	Case-⑩ DSS/GS North	South	Center	Gr. Total cost(M$)
Total M$	5,333	8,278	1,634	15,245	5,091	8,286	1,645	15,022
Capital	3,843	3,883	1,497	9,223	3,329	3,883	1,507	8,719
Fuel	508	1,269	86	1,863	532	1,275	86	1,893
O & M	288	454	16	758	303	456	16	775
Variable T.P.Repl	603 91	2,497 175	35 —	3,135 266	817 110	2,496 176	36 —	3,349 286
LOLP D/y	1.87	1.40	6.83	3.37day	1.86	1.41	5.98	3.08day
EUE(GWh)	188.1	92.7	243.9	525GWh	182.4	92.0	204.2	478GWh

LOLP=3.0%

Case / Item	Case-⑪ SS/GS(3%) North	South	Center	Gr. Total cost(M$)
Total M$	4,545	8,040	1,660	14,245
Capital	3,022	3,634	1,464	8,120
Fuel	478	1,316	95	1,889
O & M	262	453	17	732
Variable T.P.Repl	707 76	2,478 159	84 —	3,269 235
LOLP D/y	4.72	3.70	8.48	5.63day
EUE(GWh)	409.0	287.0	337.0	1,033GWh

All costs are discounted value in million US$ and include IDC.
Fuel and O&M cost are total discounted value from 1993 through 2013.
Capital cost is total value of all power plants from 1996 through 2013.

Variable : Variable cost from 2014 through 2060
T.P.Repl : Cost of Thermal Plant Replacement from 2014 through 2060

Disbursement Schedule of On-Going Power Plants

L.C. (MILLION US$)

	1993	1994	1995	1996	1997	1998	1999	2000	Total
PhaLaiB(coal)					10.1	51.1	93.9	39.9	195.0
Ba Ria(C/C)		0.8	4.3	7.8	3.3				16.3
New Gas(C/C)		4.2	20.9	38.5	16.4				80.0
New Gas(C/C)			2.1	10.5	19.3	8.2			40.0
Phu My(Gas)				8.8	44.5	81.9	34.8		170.0
Ham Thuan(H)			6.2	15.2	47.2	80.8	53.9	15.1	218.4
Da Mi(H)									0.0
Song Hinh(H)	1.2	3.1	9.5	16.3	10.9	3.0			44.0
Yaly#1,#2(H)		4.1	10.1	31.1	53.3	35.6	9.9		144.0
Yaly#3,#4(H)			1.7	4.2	13.0	22.2	14.8	4.1	60.0
Sub Total	1.2	12.1	54.7	132.5	217.9	282.7	207.4	59.1	967.7

F.C. (MILLION US$)

	1993	1994	1995	1996	1997	1998	1999	2000	Total
PhaLaiB(coal)					30.4	153.2	281.8	119.7	585.0
Ba Ria(C/C)		2.5	12.8	23.5	10.0				48.8
New Gas(C/C)		12.5	62.8	115.6	49.1				240.0
New Gas(C/C)			6.2	31.4	57.8	24.5			120.0
Phu My(Gas)				26.5	133.5	245.7	104.3		510.0
Ham Thuan(H)			9.3	22.9	70.8	121.2	80.9	22.6	327.6
Da Mi(H)									0.0
Song Hinh(H)	1.9	4.6	14.3	24.4	16.3	4.6			66.0
Yaly#1,#2(H)		6.1	15.1	46.7	79.9	53.3	14.9		216.0
Yaly#3,#4(H)			2.5	6.3	19.5	33.3	22.2	6.2	90.0
Sub Total	1.9	25.7	123.0	297.3	467.2	635.7	504.1	148.5	2,203.4

Gross Without IDC (MILLION US$)

	1993	1994	1995	1996	1997	1998	1999	2000	Total
PhaLaiB(coal)					40.5	204.2	375.7	159.5	780.0
Ba Ria(C/C)		3.4	17.0	31.3	13.3				65.0
New Gas(C/C)		16.6	83.8	154.1	65.4				320.0
New Gas(C/C)			8.3	41.9	77.1	32.7			160.0
Phu My(Gas)				35.3	178.0	327.5	139.1		680.0
Ham Thuan(H)			15.4	38.1	118.0	202.0	134.8	37.7	546.0
Da Mi(H)									0.0
Song Hinh(H)	3.1	7.7	23.8	40.7	27.2	7.6			110.0
Yaly#1,#2(H)		10.2	25.1	77.8	133.2	88.9	24.8		360.0
Yaly#3,#4(H)			4.2	10.5	32.4	55.5	37.0	10.3	150.0
Grand Total	3.1	37.9	177.7	429.8	685.1	918.4	711.5	207.6	3,171.0

TABLE 12.1.6.3 FIXED O&M COST (TOTAL) BY PLANT TYPE OF TOTAL SYSTEM

YEAR	NUCL	GAST	OILE	COAL	DSEL	GEOT	LNGP	COMB	HYDR	PUMP	TOTAL	UNIT COST (CENT/KWH)
1993	0	531	1200	7651	1274	0	0	0	0	0	10655	1.00
1994	0	771	1212	7842	1287	0	0	0	0	0	11112	0.93
1995	0	779	1224	8038	1300	0	0	0	0	0	11340	0.83
1996	0	787	1236	8239	1313	0	0	0	0	0	11574	0.76
1997	0	795	1249	8445	1326	0	0	1669	0	0	13483	0.80
1998	0	803	1261	8656	1339	0	1146	2579	0	0	15784	0.84
1999	0	738	1274	10284	1352	0	3542	2657	0	0	19848	0.95
2000	0	582	1072	11989	920	0	3648	2736	0	0	20948	0.90
2001	0	588	1083	12289	929	0	3758	2818	0	0	21465	0.82
2002	0	594	1094	12596	938	0	3870	2903	0	0	21995	0.75
2003	0	600	1105	12911	948	0	3987	5980	0	0	25529	0.78
2004	0	606	1116	16623	957	0	4106	7699	0	0	31107	0.85
2005	0	612	1127	20512	967	0	4229	7930	0	0	35377	0.87
2006	0	618	0	28146	977	0	4356	8168	0	0	42265	0.93
2007	0	624	0	45134	986	0	4487	8413	0	0	59645	1.19
2008	0	630	0	51732	996	0	4622	8665	0	0	66645	1.21
2009	0	637	0	60694	1006	0	4760	8925	0	0	76022	1.25
2010	0	643	0	77932	1016	0	4903	9193	0	0	93688	1.40
2011	0	649	0	91966	2766	0	5050	9469	0	0	109901	1.51
2012	0	656	0	106653	2794	0	5202	9753	0	0	125057	1.56
2013	0	663	0	126249	2822	0	5358	10045	0	0	145137	1.65
TOTAL	0	13905	15250	734580	28213	0	67024	109603	0	0	968575	

④ Case-SS/GS (×10³US$)

TABLE 12.2.6.3 VARIABLE O&M COST (TOTAL) BY PLANT TYPE OF TOTAL SYSTEM

YEAR	NUCL	GAST	OILE	COAL	DSEL	GEOT	LNGP	COMB	HYDR	PUMP	TOTAL	UNIT COST (CENT/KWH)
1993	0	7883	1587	0	2726	0	0	0	0	0	12196	1.14
1994	0	2155	1	773	3212	0	0	0	0	0	6141	0.51
1995	0	5358	25	5271	88	0	0	0	0	0	10741	0.78
1996	0	9782	654	6736	706	0	0	0	0	0	17878	1.18
1997	0	4229	363	7378	744	0	0	10224	0	0	22938	1.36
1998	0	5537	187	7090	493	0	1802	15475	0	0	30585	1.63
1999	0	205	15	4796	11	0	3283	15702	0	0	24012	1.15
2000	0	34	1	7281	0	0	909	11760	0	0	19986	0.86
2001	0	44	1	9146	120	0	2112	17900	0	0	29325	1.12
2002	0	256	15	11556	24	0	3950	21267	0	0	37069	1.27
2003	0	294	19	13328	130	0	2738	39520	0	0	56029	1.71
2004	0	273	17	16609	24	0	2647	49223	0	0	68792	1.88
2005	0	364	30	25279	58	0	2363	53292	0	0	81386	1.99
2006	0	245	0	44207	116	0	2490	55984	0	0	103042	2.26
2007	0	156	0	55274	90	0	1654	64449	0	0	121624	2.43
2008	0	140	0	69761	89	0	1183	68780	0	0	139953	2.54
2009	0	230	0	90585	125	0	1493	71167	0	0	163599	2.70
2010	0	234	0	117476	180	0	1356	73259	0	0	192504	2.88
2011	0	223	0	143377	592	0	1230	75456	0	0	220878	3.04
2012	0	245	0	176229	491	0	1086	77767	0	0	255818	3.20
2013	0	360	0	224561	1144	0	1385	80101	0	0	307552	3.50
TOTAL	0	38247	2916	1036713	11165	0	31682	801326	0	0	1922048	

Not Discounted

without IDC

④ Case-SS/GS (×10³US$)

TABLE 12.3.1.3 FUEL COST (TOTAL) BY PLANT TYPE OF NORTH

YEAR	NUCL	GAST	OILE	COAL	DSEL	GEOT	LNGP	COMB	HYDR	PUMP	TOTAL	UNIT COST (CENT/KWH)
1993	0	0	0	0	0	0	0	0	0	0	0	0.0
1994	0	4	0	2476	0	0	0	0	0	0	2481	0.34
1995	0	8	0	15466	0	0	0	0	0	0	15474	1.67
1996	0	13	0	19656	0	0	0	0	0	0	19669	2.01
1997	0	22	0	21525	0	0	0	0	0	0	21547	2.16
1998	0	22	0	21136	0	0	0	0	0	0	21158	2.14
1999	0	0	0	26088	0	0	0	0	0	0	26088	2.47
2000	0	0	0	40101	0	0	0	0	0	0	40101	3.49
2001	0	0	0	47267	0	0	0	0	0	0	47267	3.98
2002	0	0	0	56742	0	0	0	0	0	0	56742	4.57
2003	0	0	0	66941	0	0	0	0	0	0	66941	5.16
2004	0	0	0	66964	0	0	0	0	0	0	66964	4.52
2005	0	0	0	90132	0	0	0	0	0	0	90132	5.59
2006	0	0	0	126622	0	0	0	0	0	0	126622	6.96
2007	0	0	0	125634	0	0	0	0	0	0	125634	6.25
2008	0	0	0	129373	0	0	0	0	0	0	129373	5.78
2009	0	0	0	133138	0	0	0	0	0	0	133138	5.41
2010	0	0	0	142803	0	0	0	0	0	0	142803	5.26
2011	0	0	0	142024	0	0	0	0	0	0	142024	4.88
2012	0	0	0	155669	0	0	0	0	0	0	155669	4.79
2013	0	0	0	206600	0	0	0	0	0	0	206600	5.67
TOTAL	0	70	0	1636353	0	0	0	0	0	0	1636424	

Not Discounted

without IDC

TABLE 12.3.2.3 FUEL COST (TOTAL) BY PLANT TYPE OF SOUTH

YEAR	NUCL	GAST	OILE	COAL	DSEL	GEOT	LNGP	COMB	HYDR	PUMP	TOTAL	UNIT COST (CENT/KWH)
1993	0	17026	11607	0	1064	0	0	0	0	0	29697	6.59
1994	0	4781	7	0	0	0	0	0	0	0	4788	1.31
1995	0	12113	203	0	1	0	0	0	0	0	12317	2.99
1996	0	21401	4822	0	266	0	0	0	0	0	26488	5.42
1997	0	9272	2687	0	54	0	0	37229	0	0	49242	7.69
1998	0	12106	1416	0	111	0	13531	56462	0	0	83626	10.24
1999	0	457	107	0	21	0	25472	57312	0	0	83369	10.41
2000	0	79	9	0	0	0	7423	43012	0	0	50523	6.48
2001	0	102	11	0	0	0	16906	65311	0	0	82330	8.86
2002	0	583	113	0	0	0	30984	77509	0	0	109189	10.48
2003	0	663	138	0	0	0	21157	144241	0	0	166199	12.60
2004	0	612	123	0	0	0	20310	179738	0	0	200783	13.73
2005	0	819	221	13294	0	0	18300	194575	0	0	227209	13.52
2006	0	551	0	17109	0	0	19330	204247	0	0	241237	13.33
2007	0	349	0	53080	0	0	12789	234915	0	0	301133	14.70
2008	0	314	0	106254	0	0	9281	250702	0	0	366552	15.98
2009	0	516	0	182162	0	0	11632	259402	0	0	453711	17.37
2010	0	520	0	271972	0	0	10457	267041	0	0	549991	18.61
2011	0	495	0	373400	0	0	9374	275038	0	0	658306	19.78
2012	0	546	0	485938	0	0	8366	283481	0	0	778332	20.89
2013	0	800	0	597108	0	0	10667	291988	0	0	900562	21.88
TOTAL	0	84104	21462	2100316	1518	0	245979	2922200	0	0	5375580	

Case-SS/GS (×10³US$)

TABLE 12.3.3.3 FUEL COST (TOTAL) BY PLANT TYPE OF CENTER

YEAR	NUCL	GAST	OILE	COAL	DSEL	GEOT	LNGP	COMB	HYDR	PUMP	TOTAL	UNIT COST (CENT/KWH)
1993	0	0	0	0	30581	0	0	0	0	0	30581	39.16
1994	0	0	0	0	38547	0	0	0	0	0	38547	40.17
1995	0	0	0	0	1050	0	0	0	0	0	1050	3.35
1996	0	0	0	0	7940	0	0	0	0	0	7940	16.87
1997	0	0	0	0	8825	0	0	0	0	0	8825	18.05
1998	0	0	0	0	5697	0	0	0	0	0	5697	8.02
1999	0	0	0	0	92	0	0	0	0	0	92	0.04
2000	0	0	0	0	3	0	0	0	0	0	3	0.00
2001	0	0	0	0	1445	0	0	0	0	0	1445	0.29
2002	0	0	0	0	290	0	0	0	0	0	290	0.05
2003	0	0	0	0	1565	0	0	0	0	0	1565	0.24
2004	0	0	0	0	285	0	0	0	0	0	285	0.04
2005	0	0	0	0	692	0	0	0	0	0	692	0.09
2006	0	0	0	0	1387	0	0	0	0	0	1387	0.15
2007	0	0	0	0	1083	0	0	0	0	0	1083	0.11
2008	0	0	0	0	1071	0	0	0	0	0	1071	0.11
2009	0	0	0	0	1505	0	0	0	0	0	1505	0.15
2010	0	0	0	0	2159	0	0	0	0	0	2159	0.21
2011	0	0	0	0	7108	0	0	0	0	0	7108	0.70
2012	0	0	0	0	5891	0	0	0	0	0	5891	0.58
2013	0	0	0	0	13734	0	0	0	0	0	13734	1.33
TOTAL	0	0	0	0	130948	0	0	0	0	0	130948	

Not Discounted

TABLE 12.3.6.3 FUEL COST (TOTAL) BY PLANT TYPE OF TOTAL SYSTEM

YEAR	NUCL	GAST	OILE	COAL	DSEL	GEOT	LNGP	COMB	HYDR	PUMP	TOTAL	UNIT COST (CENT/KWH)
1993	0	17026	11607	0	31645	0	0	0	0	0	60278	5.66
1994	0	4785	7	2476	38547	0	0	0	0	0	45815	3.82
1995	0	12122	203	15466	1051	0	0	0	0	0	28841	2.11
1996	0	21414	4822	19656	8206	0	0	0	0	0	54097	3.57
1997	0	9294	2687	21525	8878	0	0	37229	0	0	79613	4.72
1998	0	12128	1416	21136	5809	0	13531	56462	0	0	110481	5.89
1999	0	457	107	26088	113	0	25472	57312	0	0	109549	5.24
2000	0	79	9	40101	3	0	7423	43012	0	0	90627	3.89
2001	0	102	11	47267	1445	0	16906	65311	0	0	131042	5.01
2002	0	583	113	56742	290	0	30984	77509	0	0	166220	5.68
2003	0	663	138	66941	1565	0	21157	144241	0	0	234704	7.18
2004	0	612	123	66964	285	0	20310	179738	0	0	268032	7.33
2005	0	819	221	103426	692	0	18300	194575	0	0	318032	7.78
2006	0	551	0	143730	1387	0	19330	204247	0	0	369246	8.11
2007	0	349	0	178713	1083	0	12789	234915	0	0	427850	8.54
2008	0	314	0	235627	1071	0	9281	250702	0	0	496995	9.01
2009	0	516	0	315299	1505	0	11632	259402	0	0	588354	9.69
2010	0	520	0	414776	2159	0	10457	267041	0	0	694953	10.40
2011	0	495	0	515424	7108	0	9374	275038	0	0	807438	11.12
2012	0	546	0	641607	5891	0	8366	283481	0	0	939891	11.76
2013	0	800	0	803708	13734	0	10667	291988	0	0	1120894	12.74
TOTAL	0	84174	21462	3736669	132465	0	245979	2922200	0	0	7142951	

Case-SS/GS (×10³US$)

TABLE 12.4.5 CAPITAL COST BY PLANT TYPE OF NORTH

(K$,DISCOUNTED)

YEAR	NUCL	GAST	OILE	COAL	DSEL	GEOT	LNGP	COMB	HYDR	PUMP	TOTAL
1993	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	11105	0	11105
1999	0	0	0	0	0	0	0	0	52749	0	52749
2000	0	0	0	13260	0	0	0	0	100251	0	113511
2001	0	0	0	55467	0	0	0	0	190889	0	246356
2002	0	0	0	107121	0	0	0	0	205729	0	312850
2003	0	0	0	151696	0	0	0	0	255386	0	407082
2004	0	0	0	265853	0	0	0	0	160409	0	426262
2005	0	0	0	241843	0	0	0	0	134565	0	376408
2006	0	0	0	75391	0	0	0	0	77415	0	152806
2007	0	0	0	31310	0	0	0	0	61339	0	92649
2008	0	0	0	48096	0	0	0	0	79474	0	127570
2009	0	0	0	33877	0	0	0	0	101778	0	135655
2010	0	0	0	70571	0	0	0	0	65044	0	135614
2011	0	0	0	108405	0	0	0	0	21110	0	129515
2012	0	0	0	38331	0	0	0	0	2524	0	40856
2013	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	1241221	0	0	0	0	1519762	0	2760982

Discounted

TABLE 12.4.6 CAPITAL COST BY PLANT TYPE OF SOUTH

(K$,DISCOUNTED)

YEAR	NUCL	GAST	OILE	COAL	DSEL	GEOT	LNGP	COMB	HYDR	PUMP	TOTAL
1993	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0
1998	0	0	0	0	0	0	0	0	0	0	0
1999	0	0	0	0	0	0	0	18670	9945	0	28615
2000	0	0	0	0	0	0	0	86584	25755	0	112339
2001	0	0	0	12055	0	0	0	155466	62398	0	229919
2002	0	0	0	50425	0	0	0	96950	102145	0	249519
2003	0	0	0	97383	0	0	0	19282	82870	0	199535
2004	0	0	0	128849	0	0	0	0	33153	0	162002
2005	0	0	0	220267	0	0	0	0	5590	0	225857
2006	0	0	0	252998	0	0	0	0	0	0	252998
2007	0	0	0	261308	0	0	0	0	0	0	261308
2008	0	0	0	285649	0	0	0	0	0	0	285649
2009	0	0	0	265440	0	0	0	0	0	0	265440
2010	0	0	0	189150	0	0	0	0	0	0	189150
2011	0	0	0	78299	0	0	0	0	0	0	78299
2012	0	0	0	12777	0	0	0	0	0	0	12777
2013	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	1854598	0	0	0	376952	321855	0	2553404

Case-SS/GS (×10³US$)

TABLE 12.4.7 CAPITAL COST BY PLANT TYPE OF CENTER

(K$,DISCOUNTED)

YEAR	NUCL	GAST	OILE	COAL	DSEL	GEOT	LNGP	COMB	HYDR	PUMP	TOTAL
1993	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	9729	0	9729
1996	0	0	0	0	0	0	0	0	30007	0	30007
1997	0	0	0	0	0	0	0	0	70580	0	70580
1998	0	0	0	0	0	0	0	0	137426	0	137426
1999	0	0	0	0	0	0	0	0	144305	0	144305
2000	0	0	0	0	0	0	0	0	135640	0	135640
2001	0	0	0	0	0	0	0	0	145304	0	145304
2002	0	0	0	0	0	0	0	0	140086	0	140086
2003	0	0	0	0	0	0	0	0	127444	0	127444
2004	0	0	0	0	0	0	0	0	73644	0	73644
2005	0	0	0	0	0	0	0	0	23593	0	23593
2006	0	0	0	0	0	0	0	0	2825	0	2825
2007	0	0	0	0	0	0	0	0	0	0	0
2008	0	0	0	0	0	0	0	0	0	0	0
2009	0	0	0	0	0	0	0	0	0	0	0
2010	0	0	0	0	0	0	0	0	0	0	0
2011	0	0	0	0	0	0	0	0	0	0	0
2012	0	0	0	0	0	0	0	0	0	0	0
2013	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	1040582	0	1040582

Discounted

TABLE 12.4.8 CAPITAL COST BY PLANT TYPE OF TOTAL SYSTEM

(K$,DISCOUNTED)

YEAR	NUCL	GAST	OILE	COAL	DSEL	GEOT	LNGP	COMB	HYDR	PUMP	TOTAL
1993	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	9729	0	9729
1996	0	0	0	0	0	0	0	0	30007	0	30007
1997	0	0	0	0	0	0	0	0	70580	0	70580
1998	0	0	0	0	0	0	0	0	137426	0	148531
1999	0	0	0	0	0	0	0	0	144305	0	225669
2000	0	0	0	0	0	0	0	0	135640	0	361490
2001	0	0	0	0	0	0	0	0	145304	0	621580
2002	0	0	0	0	0	0	0	0	140086	0	702456
2003	0	0	0	0	0	0	0	0	127444	0	734061
2004	0	0	0	0	0	0	0	0	73644	0	661908
2005	0	0	0	0	0	0	0	0	23593	0	625858
2006	0	0	0	0	0	0	0	0	2825	0	408629
2007	0	0	0	0	0	0	0	0	0	0	353957
2008	0	0	0	0	0	0	0	0	0	0	413218
2009	0	0	0	0	0	0	0	0	0	0	401095
2010	0	0	0	0	0	0	0	0	0	0	324764
2011	0	0	0	0	0	0	0	0	0	0	207814
2012	0	0	0	0	0	0	0	0	0	0	53633
2013	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	3095814	0	0	0	376952	2882193	0	6354970

TABLE 13.1.1.1 CONSTRUCTION COSTS (DOMESTIC) OF NORTH

CONSTRUCTION COSTS (DOMESTIC) OF NORTH

(M$)

YEAR	#	PLANT	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
2004	1	HBAN	0.0	0.0	0.0	0.0	0.0	4.3	10.6	32.8	56.2	37.5	10.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	151.9
2004	1	CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	19.6	36.1	15.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.0
2006	2	CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.8	39.3	72.3	30.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	150.0
2007	1	HSON	0.0	0.0	0.0	0.0	0.0	0.0	10.8	18.3	54.1	91.9	165.6	103.1	91.4	22.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	557.8
2007	3	CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.7	58.9	108.4	46.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	225.0
2008	1	HSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.1	3.2	5.4	9.7	6.0	5.4	1.3	0.0	0.0	0.0	0.0	0.0	0.0	32.6
2009	1	HSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.1	3.2	5.4	9.7	6.0	5.4	1.3	0.0	0.0	0.0	0.0	0.0	32.6
2010	1	HSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.1	3.2	5.4	9.7	6.0	5.4	1.3	0.0	0.0	0.0	0.0	32.6
2010	1	CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	19.6	36.1	15.3	0.0	0.0	0.0	0.0	75.0
2011	1	HSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.1	3.2	5.4	9.7	6.0	5.4	1.3	0.0	0.0	0.0	32.6
2012	1	HDAI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	8.4	26.0	44.5	29.7	8.3	0.0	0.0	120.2
2012	1	HHOU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8	14.4	44.5	76.2	50.8	14.2	0.0	0.0	206.0
2013	3	CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.7	58.9	108.4	46.0	0.0	225.0
2013	1	HHOU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	3.1	9.5	16.3	10.9	3.0	0.0	44.0
		TOTAL	0.0	0.0	0.0	0.0	0.0	4.3	21.4	55.6	131.7	178.2	252.7	253.6	254.7	108.1	66.1	122.3	164.0	157.0	141.8	49.0	0.0	1960.5

TABLE 13.1.1.2 CONSTRUCTION COSTS (FOREIGN) OF NORTH

CONSTRUCTION COSTS (FOREIGN) OF NORTH

(M$)

YEAR	#	PLANT	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
2004	1	HBAN	0.0	0.0	0.0	0.0	0.0	6.4	15.9	49.2	84.3	56.2	15.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	227.8
2004	1	CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.6	78.6	144.5	61.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	300.0
2006	2	CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.3	157.1	289.0	122.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	600.0
2007	1	HSON	0.0	0.0	0.0	0.0	0.0	0.0	16.2	27.4	81.1	137.8	248.2	154.5	137.1	33.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	836.2
2007	3	CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.9	235.7	433.5	183.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	900.0
2008	1	HSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	4.3	12.7	21.6	38.9	24.2	21.5	5.3	0.0	0.0	0.0	0.0	0.0	0.0	131.0
2009	1	HSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	4.3	12.7	21.6	38.9	24.2	21.5	5.3	0.0	0.0	0.0	0.0	0.0	131.0
2010	1	HSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	4.3	12.7	21.6	38.9	24.2	21.5	5.3	0.0	0.0	0.0	0.0	131.0
2010	1	CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.6	78.6	144.5	61.3	0.0	0.0	0.0	0.0	300.0
2011	1	HSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	4.3	12.7	21.6	38.9	24.2	21.5	5.3	0.0	0.0	0.0	131.0
2012	1	HDAI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	12.6	39.0	66.8	44.6	12.5	0.0	0.0	180.5
2012	1	HHOU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.7	21.6	66.6	114.3	76.2	21.3	0.0	0.0	308.8
2013	3	CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.9	235.7	433.5	183.9	0.0	900.0
2013	1	HHOU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	12.3	38.0	65.1	43.4	12.2	0.0	176.0
		TOTAL	0.0	0.0	0.0	0.0	0.0	6.4	32.1	94.8	250.9	389.4	570.4	756.7	790.6	353.3	207.6	313.4	354.1	426.9	510.8	196.1	0.0	5253.5

TABLE 13.1.2.1 CONSTRUCTION COSTS (DOMESTIC) OF SOUTH

CONSTRUCTION COSTS (DOMESTIC) OF SOUTH

(M$)

YEAR	#	PLANT	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
2003	2	NEW	0.0	0.0	0.0	0.0	0.0	0.0	5.0	25.1	46.2	19.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	96.0
2004	1	NEW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	12.6	23.1	9.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.0
2005	1	HDAI	0.0	0.0	0.0	0.0	0.0	0.0	4.2	10.5	32.3	55.4	36.9	10.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	149.7
2005	1	NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	19.6	36.1	15.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.0
2006	1	HDON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.8	7.0	21.6	37.0	24.7	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
2007	2	NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.8	39.3	72.3	30.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	150.0
2008	2	NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.8	39.3	72.3	30.7	0.0	0.0	0.0	0.0	0.0	0.0	150.0
2009	2	NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.8	39.3	72.3	30.7	0.0	0.0	0.0	0.0	0.0	150.0
2010	3	NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.7	58.9	108.4	46.0	0.0	0.0	0.0	0.0	225.0
2011	3	NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.7	58.9	108.4	46.0	0.0	0.0	0.0	225.0
2012	3	NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.7	58.9	108.4	46.0	0.0	0.0	225.0
2013	1	NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	19.6	36.1	15.3	0.0	75.0
		TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	9.2	40.9	102.0	139.4	127.7	97.4	126.3	153.9	173.5	209.7	217.2	174.0	82.1	15.3	0.0	1668.7

TABLE 13.1.2.2 CONSTRUCTION COSTS (FOREIGN) OF SOUTH

CONSTRUCTION COSTS (FOREIGN) OF SOUTH

(M$)

YEAR	#	PLANT	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
2003	2	NEW	0.0	0.0	0.0	0.0	0.0	0.0	20.0	100.5	185.0	78.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	384.0
2004	1	NEW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0	50.3	92.5	39.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	192.0
2005	1	HDAI	0.0	0.0	0.0	0.0	0.0	0.0	6.3	15.7	48.4	83.1	55.4	15.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	224.4
2005	1	NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.6	78.6	144.5	61.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	300.0
2006	1	HDON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	10.5	32.4	55.5	37.0	10.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	150.0
2007	2	NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.3	157.1	289.0	122.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	600.0
2008	2	NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.3	157.1	289.0	122.6	0.0	0.0	0.0	0.0	0.0	0.0	600.0
2009	2	NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.3	157.1	289.0	122.6	0.0	0.0	0.0	0.0	0.0	600.0
2010	3	NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.9	235.7	433.5	183.9	0.0	0.0	0.0	0.0	900.0
2011	3	NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.9	235.7	433.5	183.9	0.0	0.0	0.0	900.0
2012	3	NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.9	235.7	433.5	183.9	0.0	0.0	900.0
2013	1	NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.6	78.6	144.5	61.3	0.0	300.0
		TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	26.3	130.5	309.8	364.9	325.9	302.2	487.8	615.6	694.2	838.7	868.7	696.0	328.4	61.3	0.0	6050.4

TABLE 13.1.3.1 CONSTRUCTION COSTS (DOMESTIC) OF CENTER

(M$)

YEAR	# PLANT	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
2001	1 HPLI	0.0	0.0	2.8	7.0	21.6	37.0	24.7	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
2002	1 HSE	0.0	0.0	0.0	2.1	5.3	16.2	27.8	18.6	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	75.2
2002	1 HSUO	0.0	0.0	0.0	1.3	3.2	9.9	17.0	11.4	3.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.0
2004	1 HAN	0.0	0.0	0.0	0.0	0.0	1.9	4.8	14.8	25.5	17.0	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	68.8
2004	1 HTHU	0.0	0.0	0.0	0.0	0.0	3.1	7.7	23.8	40.9	27.3	7.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	110.5
2005	1 HSON	0.0	0.0	0.0	0.0	0.0	0.0	1.1	2.8	8.6	14.8	9.9	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0
2006	1 HSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8	14.4	44.4	76.1	50.8	14.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	205.7
2007	1 HRAO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	3.9	12.0	20.6	13.7	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55.6
	TOTAL	0.0	0.0	2.8	10.4	30.1	68.2	83.2	84.1	99.3	107.3	110.4	74.1	27.9	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	701.8

TABLE 13.1.3.2 CONSTRUCTION COSTS (FOREIGN) OF CENTER

(M$)

YEAR	# PLANT	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
2001	1 HPLI	0.0	0.0	4.2	10.5	32.4	55.5	37.0	10.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	150.0
2002	1 HSE	0.0	0.0	0.0	3.2	7.9	24.4	41.8	27.9	7.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	112.9
2002	1 HSUO	0.0	0.0	0.0	1.9	4.8	14.9	25.5	17.0	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	68.9
2004	1 HAN	0.0	0.0	0.0	0.0	0.0	2.9	7.2	22.3	38.2	25.5	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	103.2
2004	1 HTHU	0.0	0.0	0.0	0.0	0.0	4.7	11.6	35.7	61.3	40.9	11.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	165.6
2005	1 HSON	0.0	0.0	0.0	0.0	0.0	0.0	1.7	4.2	12.9	22.2	14.8	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	60.0
2006	1 HSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.7	21.6	66.5	114.1	76.1	21.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	308.2
2007	1 HRAO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	5.8	18.0	30.9	20.6	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	83.4
	TOTAL	0.0	0.0	4.2	15.6	45.1	102.3	124.8	126.1	148.9	160.9	165.4	111.1	41.9	5.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1052.2

TABLE 13.3.1.1 CONSTRUCTION & IDC (DOMESTIC) OF NORTH

(M$)

YEAR	# PLANT	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
2004	1 HBAN	0.0	0.0	0.0	0.0	0.0	7.5	16.4	46.0	71.8	43.5	11.2	0.0
2004	1 CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	24.9	42.1	16.4	0.0
2006	2 CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8	49.9	84.3
2007	1 HSON	0.0	0.0	0.0	0.0	0.0	0.0	22.9	33.3	93.3	142.5	232.5	133.2
2007	3 CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.3	74.8
2008	1 HSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.9	5.5	8.3	13.6
2009	1 HSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.9	5.5	8.3
2010	1 HSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.9	5.5
2010	1 CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2011	1 HSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	1.9
2012	1 HDAI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2012	1 HHOU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2013	3 CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2013	1 HHOU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	0.0	0.0	0.0	0.0	0.0	7.5	39.2	86.0	193.3	247.7	343.3	321.6

TABLE 13.3.1.1 CONSTRUCTION & IDC (DOMESTIC) OF NORTH

(M$)

YEAR	# PLANT	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
2004	1 HBAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	196.4
2004	1 CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	88.9
2006	2 CQUA	32.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	177.8
2007	1 HSON	106.6	23.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	788.9
2007	3 CQUA	126.4	49.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	266.7
2008	1 HSON	7.8	6.2	1.4	0.0	0.0	0.0	0.0	0.0	0.0	46.1
2009	1 HSON	13.6	7.8	6.2	1.4	0.0	0.0	0.0	0.0	0.0	46.1
2010	1 HSON	8.3	13.6	7.8	6.2	1.4	0.0	0.0	0.0	0.0	46.1
2010	1 CQUA	0.0	5.4	24.9	42.1	16.4	0.0	0.0	0.0	0.0	88.9
2011	1 HSON	5.5	8.3	13.6	7.8	6.2	1.4	0.0	0.0	0.0	46.1
2012	1 HDAI	0.0	5.9	13.0	36.4	56.8	34.5	8.9	0.0	0.0	155.5
2012	1 HHOU	0.0	10.2	22.2	62.4	97.4	59.1	15.2	0.0	0.0	266.4
2013	3 CQUA	0.0	0.0	0.0	0.0	16.3	74.8	126.4	49.2	0.0	266.7
2013	1 HHOU	0.0	0.0	2.2	4.7	13.3	20.8	12.6	3.2	0.0	56.9
	TOTAL	301.0	130.5	91.3	161.2	207.8	190.5	163.1	52.4	0.0	2536.7

TABLE 13.3.1.2 CONSTRUCTION & IDC (FOREIGN) OF NORTH

(M$)

YEAR	#	PLANT	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
2004	1	HBAN	0.0	0.0	0.0	0.0	0.0	11.3	24.5	69.0	107.7	65.3	16.8	0.0
2004	1	CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.7	99.8	168.6	65.6	0.0
2006	2	CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.4	199.5	337.1
2007	1	HSON	0.0	0.0	0.0	0.0	0.0	0.0	34.3	49.9	139.9	213.6	348.6	199.6
2007	3	CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	65.0	299.3
2008	1	HSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	7.8	21.9	33.5	54.6
2009	1	HSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	7.8	21.9	33.5
2010	1	HSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	7.8	21.9
2010	1	CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2011	1	HSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	7.8
2012	1	HDAI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2012	1	HHOU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2013	3	CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2013	1	HHOU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		TOTAL	0.0	0.0	0.0	0.0	0.0	11.3	58.8	146.0	360.5	525.9	764.1	953.9

TABLE 13.3.1.2 CONSTRUCTION & IDC (FOREIGN) OF NORTH

(M$)

YEAR	#	PLANT	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
2004	1	HBAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	294.6
2004	1	CQUA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	355.6
2006	2	CQUA	131.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	711.2
2007	1	HSON	159.8	35.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1181.4
2007	3	CQUA	505.7	196.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1066.7
2008	1	HSON	31.3	25.0	5.6	0.0	0.0	0.0	0.0	0.0	0.0	185.1
2009	1	HSON	54.6	31.3	25.0	5.6	0.0	0.0	0.0	0.0	0.0	185.1
2010	1	HSON	33.5	54.6	31.3	25.0	5.6	0.0	0.0	0.0	0.0	185.1
2010	1	CQUA	0.0	21.7	99.8	168.6	65.6	0.0	0.0	0.0	0.0	355.6
2011	1	HSON	21.9	33.5	54.6	31.3	25.0	5.6	0.0	0.0	0.0	185.1
2012	1	HDAI	0.0	8.9	19.4	54.7	85.3	51.7	13.3	0.0	0.0	233.4
2012	1	HHOU	0.0	15.3	33.3	93.6	146.0	88.5	22.7	0.0	0.0	399.3
2013	3	CQUA	0.0	0.0	0.0	0.0	65.0	299.3	505.7	196.7	0.0	1066.7
2013	1	HHOU	0.0	0.0	8.7	19.0	53.3	83.2	50.5	13.0	0.0	227.6
		TOTAL	938.0	422.7	277.7	397.7	445.9	528.4	592.2	209.7	0.0	6632.7

TABLE 13.3.2.1 CONSTRUCTION & IDC (DOMESTIC) OF SOUTH

(M$)

YEAR	# PLANT	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
2003	2 NEW	0.0	0.0	0.0	0.0	0.0	0.0	6.9	31.9	53.9	21.0	0.0	0.0
2004	1 NEW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	16.0	27.0	10.5	0.0
2005	1 HDAI	0.0	0.0	0.0	0.0	0.0	0.0	7.4	16.1	45.4	70.8	42.9	11.0
2005	1 NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.4	24.9	42.1	16.4
2006	1 HDON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.9	10.8	30.3	47.3	28.7
2007	2 NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8	49.9
2008	2 NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8
2009	2 NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2010	3 NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2011	3 NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2012	3 NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2013	1 NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	14.3	56.5	131.5	174.0	153.7	116.8

TABLE 13.3.2.1 CONSTRUCTION & IDC (DOMESTIC) OF SOUTH

(M$)

YEAR	# PLANT	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
2003	2 NEW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	113.8
2004	1 NEW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.9
2005	1 HDAI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	193.6
2005	1 NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	88.9
2006	1 HDON	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	129.3
2007	2 NEW+	84.3	32.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	177.8
2008	2 NEW+	49.9	84.3	32.8	0.0	0.0	0.0	0.0	0.0	0.0	177.8
2009	2 NEW+	10.8	49.9	84.3	32.8	0.0	0.0	0.0	0.0	0.0	177.8
2010	3 NEW+	0.0	16.3	74.8	126.4	49.2	0.0	0.0	0.0	0.0	266.7
2011	3 NEW+	0.0	0.0	16.3	74.8	126.4	49.2	0.0	0.0	0.0	266.7
2012	3 NEW+	0.0	0.0	0.0	16.3	74.8	126.4	49.2	0.0	0.0	266.7
2013	1 NEW+	0.0	0.0	0.0	0.0	5.4	24.9	42.1	16.4	0.0	88.9
	TOTAL	152.4	183.2	208.1	250.3	255.8	200.5	91.3	16.4	0.0	2004.8

TABLE 13.3.2.2 CONSTRUCTION & IDC (FOREIGN) OF SOUTH

(M$)

YEAR	# PLANT	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
2003	2 NEW	0.0	0.0	0.0	0.0	0.0	0.0	27.8	127.7	215.8	83.9	0.0	0.0
2004	1 NEW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.9	63.8	107.9	42.0	0.0
2005	1 HDAI	0.0	0.0	0.0	0.0	0.0	0.0	11.1	24.2	68.0	106.1	64.3	16.5
2005	1 NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.7	99.8	168.6	65.6
2006	1 HDON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.4	16.2	45.5	70.9	43.0
2007	2 NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.4	199.5
2008	2 NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	43.4
2009	2 NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2010	3 NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2011	3 NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2012	3 NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2013	1 NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	38.8	173.1	385.4	443.1	389.1	368.0

TABLE 13.3.2.2 CONSTRUCTION & IDC (FOREIGN) OF SOUTH

(M$)

YEAR	# PLANT	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
2003	2 NEW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	455.1
2004	1 NEW	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	227.6
2005	1 HDAI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	290.2
2005	1 NEW+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	355.6
2006	1 HDON	11.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	194.0
2007	2 NEW+	337.1	131.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	711.2
2008	2 NEW+	199.5	337.1	131.1	0.0	0.0	0.0	0.0	0.0	0.0	711.2
2009	2 NEW+	43.4	199.5	337.1	131.1	0.0	0.0	0.0	0.0	0.0	711.2
2010	3 NEW+	0.0	65.0	299.3	505.7	196.7	0.0	0.0	0.0	0.0	1066.7
2011	3 NEW+	0.0	0.0	65.0	299.3	505.7	196.7	0.0	0.0	0.0	1066.7
2012	3 NEW+	0.0	0.0	0.0	65.0	299.3	505.7	196.7	0.0	0.0	1066.7
2013	1 NEW+	0.0	0.0	0.0	0.0	21.7	99.8	168.6	65.6	0.0	355.6
	TOTAL	591.1	732.8	832.6	1001.2	1023.4	802.2	365.3	65.6	0.0	7211.7

TABLE 13.3.3.1 CONSTRUCTION & IDC (DOMESTIC) OF CENTER

Case-SS/GS

(M$)

YEAR	# PLANT	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
2001	1 HPLI	0.0	0.0	4.9	10.8	30.3	47.3	28.7	7.4	0.0	0.0	0.0	0.0
2002	1 HSE	0.0	0.0	0.0	3.7	8.1	22.8	35.6	21.6	5.5	0.0	0.0	0.0
2002	1 HBUO	0.0	0.0	0.0	2.3	5.0	13.9	21.7	13.2	3.4	0.0	0.0	0.0
2004	1 HAN	0.0	0.0	0.0	0.0	0.0	3.4	7.4	20.8	32.5	19.7	5.1	0.0
2004	1 HTHU	0.0	0.0	0.0	0.0	0.0	5.5	11.9	33.5	52.2	31.7	8.1	0.0
2005	1 HSON	0.0	0.0	0.0	0.0	0.0	0.0	2.0	4.3	12.1	18.9	11.5	2.9
2006	1 HSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.2	22.2	62.3	97.2	59.0
2007	1 HRAO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	6.0	16.8	26.3
	TOTAL	0.0	0.0	4.9	16.8	43.3	92.9	107.3	110.9	130.7	138.6	138.8	88.2

TABLE 13.3.3.1 CONSTRUCTION & IDC (DOMESTIC) OF CENTER

(M$)

YEAR	# PLANT	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
2001	1 HPLI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	129.3
2002	1 HSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	97.3
2002	1 HBUO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	59.5
2004	1 HAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	89.0
2004	1 HTHU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	142.9
2005	1 HSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	51.8
2006	1 HSE	15.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	266.0
2007	1 HRAO	15.9	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	71.9
	TOTAL	31.1	4.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	907.5

TABLE 13.3.3.2 CONSTRUCTION & IDC (FOREIGN) OF CENTER

(M$)

YEAR	# PLANT	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
2001	1 HPLI	0.0	0.0	7.4	16.2	45.5	70.9	43.0	11.0	0.0	0.0	0.0	0.0
2002	1 HSE	0.0	0.0	0.0	5.6	12.2	34.2	53.4	32.4	8.3	0.0	0.0	0.0
2002	1 HBUO	0.0	0.0	0.0	3.4	7.4	20.9	32.6	19.8	5.1	0.0	0.0	0.0
2004	1 HAN	0.0	0.0	0.0	0.0	0.0	5.1	11.1	31.3	48.8	29.6	7.6	0.0
2004	1 HTHU	0.0	0.0	0.0	0.0	0.0	8.2	17.8	50.2	78.3	47.5	12.2	0.0
2005	1 HSON	0.0	0.0	0.0	0.0	0.0	0.0	3.0	6.5	18.2	28.4	17.2	4.4
2006	1 HSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.2	33.2	93.4	145.7	88.3
2007	1 HRAO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	9.0	25.3	39.4
	TOTAL	0.0	0.0	7.4	25.1	65.0	139.3	160.9	166.3	196.0	207.8	207.9	132.2

TABLE 13.3.3.2 CONSTRUCTION & IDC (FOREIGN) OF CENTER

(M$)

YEAR	# PLANT	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
2001	1 HPLI	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	194.0
2002	1 HSE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	145.9
2002	1 HBUO	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	89.1
2004	1 HAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	133.5
2004	1 HTHU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	214.2
2005	1 HSON	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.6
2006	1 HSE	22.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	398.5
2007	1 HRAO	23.9	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	107.8
	TOTAL	46.6	6.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1360.6

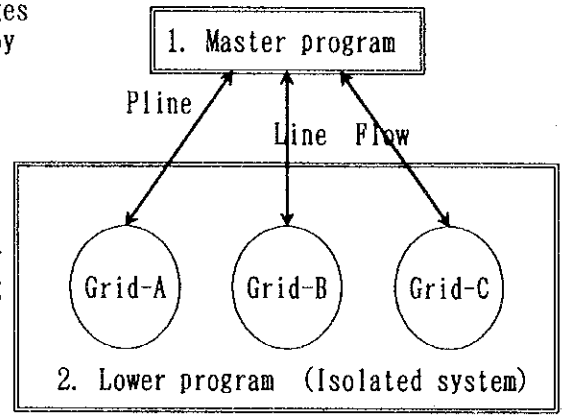
The Methodology of ESPRIT

Methodology of ESPRIT, the least cost planning of long-term power system expans -ion with interconnected grids.

ESPRIT consists mainly from the two sub-programs, the master program and the lower program. The simulation logic is ilustlated below.

1) Solve power exchanges from grid to grid by LP method.

2) Solve PDP of each independent grid by dynamic programming

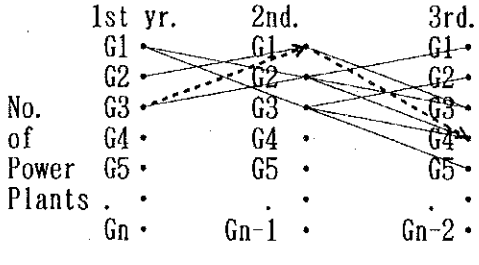


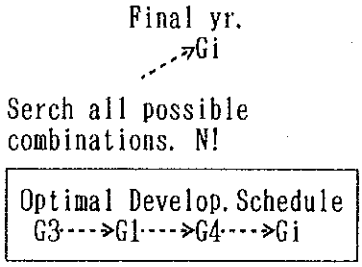
<Calculation Procedure>

(Step-1) Solve the least cost power development scenarios of each grid under the condition of fixed power exchanges (IT=0, Pline(N=0)) by dynamic programming method(DP).

<Objective> Minimize the total cost : MinΣ(Capital+Fuel+O&M-RV)
RV; Residual Value
<Constraints> Keep the reliability under a curtain level (LOLP $\leq$1%)

(Dyamic Programming)

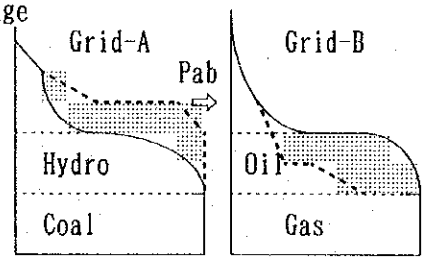




(Step-2) Transfer each PDP scinario to the Upper program and find economical and security enhenced power interchanges. (Pline(N=1))

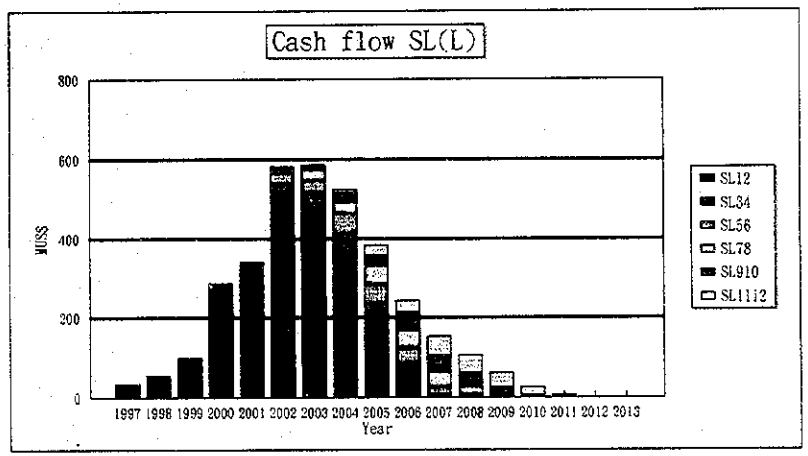
<Objective>
① Reliability oriented power exchange
② Fuel saving power exchange

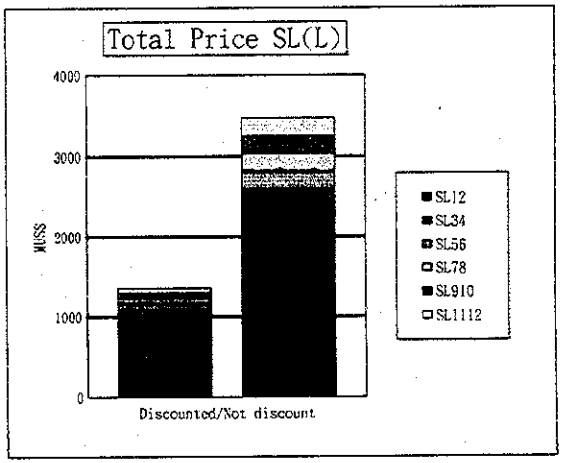
<Constraints>
Within Transmission Capacity



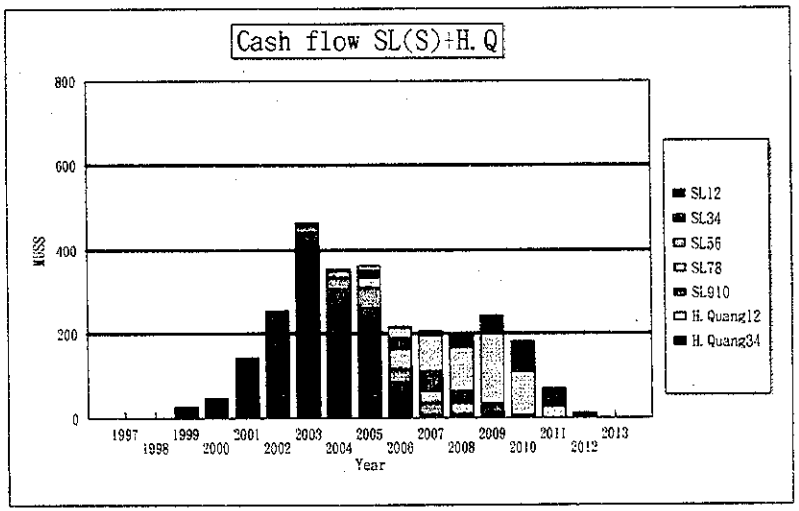
Return to Step-1 and continue the same process.

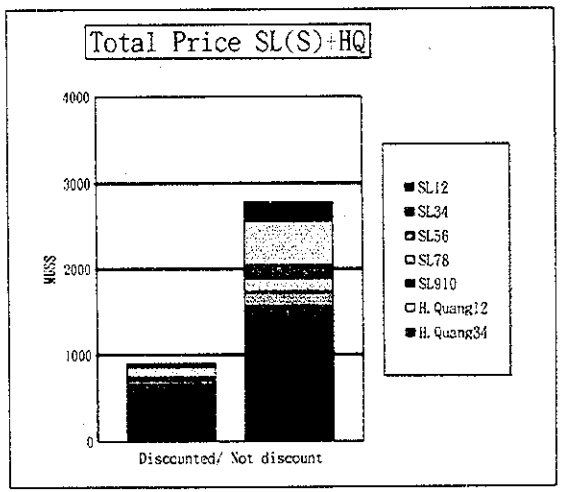
Total(MUSS) Discoounted	Not discounted	
997.4	2369.9	SL=1.2
85.2	222.6	=3.4
77.4	222.6	=5.6
70.4	222.6	=7.8
64.0	222.6	=9.10
58.2	222.6	=11.12
1352.6	**3482.9**	**SL(L)**





Total(MUSS) Discounted	Not Discounted	
538.1	1393.8	=SL1.2
57.4	163.7	=3.4
52.2	163.7	=5.6
47.5	163.7	=7.8
43.2	163.7	=9.10
118	515	H.Q=1.2
46	220	=3.4
902.4	**2783.6**	**Total**
450.2	**699.3**	**Difference**





Disbursment Schedule SL(L) and SL(S)+H.Quang

Created on 2nd June 199:File:disburse

Case:SL(L) Yr.	0	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NPV(MUS$)	1993	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
SL12		34.7	51.8	90.5	269	298	512.7	470.4	370.9	203.2	68.7							
SL34			3.3	4.9	8.5	25.2	26	48.1	44.2	34.8	19.1	6.5						
SL56				3.3	4.9	8.5	25.2	28	48.1	44.2	34.8	19.1	6.5					
SL78					3.3	4.9	8.5	25.2	28	48.1	44.2	34.8	19.1	6.5				
SL910						3.3	4.9	8.5	25.2	28	48.1	44.2	34.8	19.1	6.5			
SL1112							3.3	4.9	8.5	25.2	28	48.1	44.2	34.8	19.1	6.5		
Total	Price at 1993																	
997.44624	23.700567	32.163725	51.084891	138.03953	139.0192	217.43485	181.35956	129.99819	64.745782	19.899943								
85.176584		2.0490404	2.7659223	4.361844	11.755986	11.874733	18.544632	15.49183	11.088352	5.5325897	1.7116532							
77.433258			1.862764	2.5144748	3.9653127	10.68726	10.795212	16.858757	14.083482	10.08032	5.029627	1.5560483						
70.393871				1.6934218	2.2858862	3.6048298	9.7136909	9.8138292	15.326142	12.803166	9.1639276	4.5723881	1.4145894					
63.994428					1.5394744	2.0780783	3.277118	8.8324463	8.9216629	13.932857	11.639241	8.3308433	4.1567165	1.2859903	-			
58.176753						1.3995221	1.8891621	2.9791981	8.0294966	8.1106026	12.666233	10.581129	7.5734939	3.7788332	1.1690821			
Total(MUS$) SL(L) 1352.6211																		

Case:SL(S)+H Yr.	0	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NPV(MUS$)	1993	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
SL12				27	45.7	135.2	229.7	413.8	257.6	228.5	56.3							
SL34					3.1	5.4	15.9	27	48.6	30.2	26.9	6.6						
SL56						3.1	5.4	15.9	27	48.6	30.2	26.9	6.6					
SL78							3.1	5.4	15.9	27	48.6	30.2	26.9	6.6				
SL910								3.1	5.4	15.9	27	48.6	30.2	26.9	6.6			
H.Quang12										11.8	22.7	82.8	102.3	164.9	104.2	26		
H.Quang34											5	9.7	35.4	43.7	70.5	44.5	11.1	
Total.SL(S)	Price at 1993																	
538.11943	0	0	15.240796	23.451326	63.071798	97.415223	159.53781	90.287229	72.807142	16.308105								
57.449363		0	0	1.5907902	2.5191399	6.7431521	10.409669	17.034004	9.6226507	7.7919718	1.7379863							
52.226694			0	0	1.4461729	2.2901271	6.1301383	9.4633353	15.485458	8.7478643	7.0836107	1.5799875						
47.478813				0	0	1.3147026	2.0819338	5.572853	8.6030321	14.077689	7.9526039	6.4396461	1.4363523					
43.162557					0	0	1.1951842	1.8926671	5.06623	7.8209383	12.797899	7.2296399	5.8542238	1.3057748				
0						0	0	0	0	0	0	0	0	0	0	0		
Total(MUS$) SL(S) 738.43686																		

H.Quang12	117.80765									3.7598436	6.5753814	21.803828	24.489807	35.887044	20.615414	4.6763285		
H.Quang34	45.754211										1.4483219	2.5543132	8.4744785	9.5103932	13.948049	8.0037162	1.8149387	
Total(MUS$) H.Quang	163.56186																	
Gr.Total SL(S)+H.Quar	901.99872																	

Total difference :SL(L)-(SL(S)+H.Q)=Million US$450 at 1993

① Case-SL/GL

Variable cost (2014-2060)

		23th June 1993	not discoun 2013	discounted 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025 yr.
North	fuel(MUS$)	244.7	117.2	16.3	15.3	14.3	13.4	12.5	11.7	11.0	10.3	9.6	9.0	8.5	7.9
	O&M(V)	82.8	39.6	5.5	5.2	4.8	4.5	4.2	4.0	3.7	3.5	3.3	3.1	2.9	2.7
	O&M(F)	61.1	41.6	5.6	5.1	4.6	4.2	3.8	3.5	3.2	2.9	2.6	2.4	2.2	2.0
	Total	388.6													
	T.P.Replace	60.5													
South	fuel(MUS$)	1941.5	930.0	129.4	121.2	113.5	106.3	99.5	93.2	87.2	81.7	76.5	71.6	67.1	62.8
	O&M(V)	520.5	249.3	34.7	32.5	30.4	28.5	26.7	25.0	23.4	21.9	20.5	19.2	18.0	16.8
	O&M(F)	118.9	80.9	10.9	9.9	9.0	8.2	7.5	6.8	6.2	5.6	5.1	4.6	4.2	3.8
	Total	2580.9											PhuMy#3	PhuMy#4	P5,GC#1,2
													240	240	720
													13.754053	12.503684	34.100957
	T.P.Replace	190.3													
Central	fuel(MUS$)	32.8	15.7	2.2	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1
	O&M(V)	2.7	1.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	O&M(F)	4.1	2.8	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1
	Total	39.7													
	Gr.Total	3260.0													

③ Case-SS/GL

		23th June 1993.0	not discoun 2013	discounted 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
North	fuel(MUS$)	411.0	196.9	27.4	25.7	24.0	22.5	21.1	19.7	18.5	17.3	16.2	15.2	14.2	13.3
	O&M(V)	138.6	66.4	9.2	8.7	8.1	7.6	7.1	6.7	6.2	5.8	5.5	5.1	4.8	4.5
	O&M(F)	67.4	45.8	6.2	5.6	5.1	4.7	4.2	3.8	3.5	3.2	2.9	2.6	2.4	2.2
	Total	616.9													
	T.P.Replace	74.1													
South	fuel(MUS$)	1941.3	929.9	129.4	121.2	113.5	106.3	99.5	93.2	87.2	81.7	76.5	71.6	67.1	62.8
	O&M(V)	520.4	249.3	34.7	32.5	30.4	28.5	26.7	25.0	23.4	21.9	20.5	19.2	18.0	16.8
	O&M(F)	118.9	80.9	10.9	9.9	9.0	8.2	7.5	6.8	6.2	5.6	5.1	4.6	4.2	3.8
	Total	2580.6											PhuMy#3,4	PhuMy#5	GC/C#1,2
													480	240	480
													27.508106	12.503684	22.733972
	T.P.Replace	191.4													
Central	fuel(MUS$)	21.6	10.3	1.4	1.3	1.3	1.2	1.1	1.0	1.0	0.9	0.9	0.8	0.7	0.7
	O&M(V)	1.8	0.9	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	O&M(F)	4.1	2.8	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1
	Total	27.5													
	Gr.Total	3490.5													

Case ①

2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
7.4	6.9	6.5	6.1	5.7	5.3	5.0	4.7	4.4	4.1	3.8	3.6	3.4	3.2	3.0	2.8	2.6	2.4
2.5	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0	0.9	0.9	0.8
1.8	1.6	1.5	1.3	1.2	1.1	1.0	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.4
			Q.Ninh#1		Q.Ninh#2,3	Q.Ninh#4						Q.Ninh#5-7					
			375		750	375						1125					
			12.130944		20.051147	9.1141579						15.434114					
58.8	55.1	51.6	48.3	45.2	42.3	39.6	37.1	34.7	32.5	30.5	28.5	26.7	25.0	23.4	21.9	20.5	19.2
15.8	14.8	13.8	12.9	12.1	11.3	10.6	9.9	9.3	8.7	8.2	7.6	7.2	6.7	6.3	5.9	5.5	5.2
3.5	3.2	2.9	2.6	2.4	2.2	2.0	1.8	1.6	1.5	1.3	1.2	1.1	1.0	0.9	0.8	0.8	0.7
	GC/C#3,4	GC/C#5	GC/C#6,7						Coal#1,2	Coal#3-5	Coal#6-9	Coal#10-12					PhuMy#3
	480	240	480						750	1125	1500	1125					240
	18.788406	8.5401847	15.527608	0	0	0	0	0	13.695203	18.675277	22.6367	15.434114	0	0	0	0	2.0444523
1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.3	0.3
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Case ③

2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
12.4	11.7	10.9	10.2	9.6	9.0	8.4	7.9	7.4	6.9	6.4	6.0	5.7	5.3	5.0	4.6	4.3	4.1
4.2	3.9	3.7	3.4	3.2	3.0	2.8	2.6	2.5	2.3	2.2	2.0	1.9	1.8	1.7	1.6	1.5	1.4
2.0	1.8	1.6	1.5	1.3	1.2	1.1	1.0	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.4
			Q.Ninh#1		Q.Ninh#2,3	Q.Ninh#4,5		Q.Ninh#6			Q.Ninh#7	Q.Ninh#8					
			375		750	750		375			375	375					
			12.130944		20.051147	18.228316		7.5323619			5.659175	5.1447045					
58.8	55.1	51.6	48.3	45.2	42.3	39.6	37.1	34.7	32.5	30.5	28.5	26.7	25.0	23.4	21.9	20.5	19.2
15.8	14.8	13.8	12.9	12.1	11.3	10.6	9.9	9.3	8.7	8.2	7.6	7.2	6.7	6.3	5.9	5.5	5.2
3.5	3.2	2.9	2.6	2.4	2.2	2.0	1.8	1.6	1.5	1.3	1.2	1.1	1.0	0.9	0.8	0.8	0.7
GC/C#3		GC/C#4	GC/C#5,6	GC/C#7					Coal#1,2	Coal#3,4,5	Coal#6-9	Coal#10-12					PhuMy#3,4
240		240	480	240					750	1125	1500	1125					480
10.333623		8.5401847	15.527608	7.0580038					13.695203	18.675277	22.6367	15.434114	0	0	0	0	4.0889046
0.7	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2
0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Case ①

2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
2.3	2.1	2.0	1.9	1.7	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.0	1.0	0.9	0.8	0.8
0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3
0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
										Q.Ninh#1		Q.Ninh#2,3	Q.Ninh#4			
										375		750	375			
										1.1196376		1.8506407	0.8412003			
18.0	16.9	15.8	14.8	13.8	13.0	12.1	11.4	10.6	10.0	9.3	8.7	8.2	7.7	7.2	6.7	6.3
4.8	4.5	4.2	4.0	3.7	3.5	3.3	3.0	2.9	2.7	2.5	2.3	2.2	2.1	1.9	1.8	1.7
0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1
Phulky#4	P5,GC#1,2		GC/C#3,4	GC/C#5	GC/C#6,7											Coal#1,2
240	720		480	240	480											750
1.858593	5.06889		2.7927769	1.269444	2.3080801	0	0	0	0	0	0	0	0	0	0	1.2640125
0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Case ③

2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
3.8	3.6	3.3	3.1	2.9	2.7	2.6	2.4	2.3	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3
1.3	1.2	1.1	1.1	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.4
0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
										Q.Ninh#1		Q.Ninh#2,3	Q.Ninh#4,5		Q.Ninh#6	
										375		750	750		375	
										1.1196376		1.8506407	1.6824006		0.6952069	
18.0	16.9	15.8	14.8	13.8	13.0	12.1	11.4	10.6	10.0	9.3	8.7	8.2	7.7	7.2	6.7	6.3
4.8	4.5	4.2	4.0	3.7	3.5	3.3	3.0	2.9	2.7	2.5	2.3	2.2	2.1	1.9	1.8	1.7
0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1
Phulky#5	GC/C#1,2	GC/C#3		GC/C#4	GC/C#5,6	GC/C#7										Coal#1,2
240	480	240		240	480	240										750
1.858593	3.37926	1.5360273		1.269444	2.3080801	1.0491273	0	0	0	0	0	0	0	0	0	1.2640125
0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

yr.

Variable cost (2014-2060)

② Updated 23th June 1995
Case-SL/GS

		1993 yr	not discoun 2013	discounted 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025 yr.
North	fuel(MUS$)	262.9	125.9	17.5	16.4	15.4	14.4	13.5	12.6	11.8	11.1	10.4	9.7	9.1	8.5
	O&M(V)	90.5	43.4	6.0	5.7	5.3	5.0	4.6	4.3	4.1	3.8	3.6	3.3	3.1	2.9
	O&M(F)	67.4	45.8	6.2	5.6	5.1	4.7	4.2	3.8	3.5	3.2	2.9	2.6	2.4	2.2
	Total	420.8													
	T.P.Replace	64.8													
South	fuel(MUS$)	1885.9	903.3	125.7	117.7	110.2	103.2	96.7	90.5	84.7	79.4	74.3	69.6	65.1	61.0
	O&M(V)	490.7	235.1	32.7	30.6	28.7	26.9	25.2	23.6	22.1	20.6	19.3	18.1	17.0	15.9
	O&M(F)	129.3	88.0	11.9	10.8	9.8	8.9	8.1	7.4	6.7	6.1	5.5	5.0	4.6	4.2
	Total	2506.0											PhuMy#3	PhuMy#4,5	
													240	480	
	T.P.Replace	176.1											13.754053	25.007368	0
Central	fuel(MUS$)	33.5	16.1	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1
	O&M(V)	2.8	1.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	O&M(F)	4.1	2.8	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1
	Total	40.5													
	Gr.Total	3208.1													

④ Case-SS/GS

		1993.0	23th June not discoun 2013	discounted 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
North	fuel(MUS$)	431.3	206.6	28.8	26.9	25.2	23.6	22.1	20.7	19.4	18.1	17.0	15.9	14.9	14.0
	O&M(V)	150.1	71.9	10.0	9.4	8.8	8.2	7.7	7.2	6.7	6.3	5.9	5.5	5.2	4.9
	O&M(F)	79.8	54.3	7.3	6.7	6.1	5.5	5.0	4.6	4.1	3.8	3.4	3.1	2.8	2.6
	Total	661.2													
	T.P.Replace	87.9													
South	fuel(MUS$)	1880.1	900.6	125.3	117.4	109.9	102.9	96.4	90.2	84.5	79.1	74.1	69.4	64.9	60.8
	O&M(V)	489.6	234.5	32.6	30.6	28.6	26.8	25.1	23.5	22.0	20.6	19.3	18.1	16.9	15.8
	O&M(F)	129.3	88.0	11.9	10.8	9.8	8.9	8.1	7.4	6.7	6.1	5.5	5.0	4.6	4.2
	Total	2499.0											PhuMy#3,4	PhuMy#5	
													480	240	
	T.P.Replace	175.7											27.508106	12.503684	
Central	fuel(MUS$)	28.7	13.7	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0	0.9
	O&M(V)	2.4	1.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	O&M(F)	4.1	2.8	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1
	Total	35.2													
	Gr.Total	3459.1													

Case ②

2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
8.0	7.5	7.0	6.5	6.1	5.7	5.4	5.0	4.7	4.4	4.1	3.9	3.6	3.4	3.2	3.0	2.8	2.6
2.7	2.6	2.4	2.3	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	1.0	0.9
2.0	1.8	1.6	1.5	1.3	1.2	1.1	1.0	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.4
			Q.Ninh#1		Q.Ninh#2,3		Q.Ninh#4					Q.Ninh#5&78					
			375		750		375					1500					
			12.130944		20.051147	0	8.2855981					20.578818					
57.1	53.5	50.1	46.9	43.9	41.1	38.5	36.0	33.8	31.6	29.6	27.7	25.9	24.3	22.8	21.3	19.9	18.7
14.9	13.9	13.0	12.2	11.4	10.7	10.0	9.4	8.8	8.2	7.7	7.2	6.8	6.3	5.9	5.5	5.2	4.9
3.8	3.4	3.1	2.8	2.6	2.4	2.1	1.9	1.8	1.6	1.5	1.3	1.2	1.1	1.0	0.9	0.8	0.7
				Coal#1		Coal#2-5		Coal#6,7	Coal#8-11	Coal#12-14	Coal#14-16	Coal#17					Phuly#3
				375		1500		750	1125	1125	1125	375					240
				11.028131	0	36.456631	0	15.064724	20.542805	18.675277	16.977525	5.1447045	0	0	0	0	2.0444523
1.0	1.0	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Case ④

2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
13.1	12.2	11.5	10.7	10.0	9.4	8.8	8.2	7.7	7.2	6.8	6.3	5.8	5.6	5.2	4.9	4.6	4.3
4.5	4.3	4.0	3.7	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	1.9	1.8	1.7	1.6	1.5
2.3	2.1	1.9	1.8	1.6	1.5	1.3	1.2	1.1	1.0	0.9	0.8	0.7	0.7	0.6	0.6	0.5	0.5
			Q.Ninh#1		Q.Ninh#2,3	Q.Ninh#4-6			Q.Ninh#7			Q.Ninh#8-10					
			375		750	1125			375			1125					
			12.130944		20.051147	27.342474			6.8476017			15.434114					
56.9	53.3	49.9	46.7	43.8	41.0	38.4	35.9	33.7	31.5	29.5	27.6	25.9	24.2	22.7	21.2	19.9	18.6
14.8	13.9	13.0	12.2	11.4	10.7	10.0	9.4	8.8	8.2	7.7	7.2	6.7	6.3	5.9	5.5	5.2	4.8
3.8	3.4	3.1	2.8	2.6	2.4	2.1	1.9	1.8	1.6	1.5	1.3	1.2	1.1	1.0	0.9	0.8	0.7
				Coal#1		Coal#2,3	Coal#4,5	Coal#6,7	Coal#8-10	Coal#11-13	Coal#14-16	Coal#17					Phuly#3,4
				375		750	750	750	1125	1125	1125	375					480
				11.028131	0	18.228316	16.571196	15.064724	20.542805	18.675277	16.977525	5.1447045	0	0	0	0	4.0889046
0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Case ②

2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
2.4	2.3	2.1	2.0	1.9	1.8	1.6	1.5	1.4	1.3	1.3	1.2	1.1	1.0	1.0	0.9	0.9
0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3
0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
										Q.Ninh#1		Q.Ninh#2,3		Q.Ninh#4		
										375		750		375		
										1.1196376		1.8506407	0	0.7647275		
17.5	16.4	15.3	14.4	13.4	12.6	11.8	11.0	10.3	9.7	9.1	8.5	7.9	7.4	7.0	6.5	6.1
4.6	4.3	4.0	3.7	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	1.9	1.8	1.7	1.6
0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1
PhuMy#4,5											Coal#1		Coal#2-5		Coal#6,7	Coal#8-11
480											375		1500		750	1125
3.717186	0	0	0			0	0	0	0	0	1.0178524	0	3.3648012	0	1.3904137	1.8960187
0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Case ④

2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
4.0	3.7	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4
1.4	1.3	1.2	1.1	1.1	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.5
0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
										Q.Ninh#1		Q.Ninh#2,3	Q.Ninh#4-6			Q.Ninh#7
										375		750	1125			375
										1.1196376		1.8506407	2.5236009			0.6320062
17.4	16.3	15.3	14.3	13.4	12.6	11.8	11.0	10.3	9.6	9.0	8.5	7.9	7.4	6.9	6.5	6.1
4.5	4.3	4.0	3.7	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	1.9	1.8	1.7	1.6
0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1
PhuMy#5											Coal#1		Coal#2,3	Coal#4,5	Coal#6,7	Coal#8-10
240											375		750	750	750	1125
1.858593	0	0	0	0	0	0	0	0	0	0	1.0178524	0	1.6824006	1.5294551	1.3904137	1.8960187
0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

(01) W/0 SonLa(GL) DM=Base

21th June not discoun discounted — Variable cost (2014-2060)

		1993.0	Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
North	fuel(MUS$)	866.2		414.9	57.7	54.1	50.6	47.4	44.4	41.6	38.9	36.4	34.1	32.0	29.9	28.0
	O&M(V)	304.2		145.7	20.3	19.0	17.8	16.6	15.6	14.6	13.7	12.8	12.0	11.2	10.5	9.8
	O&M(F)	111.0		75.5	10.2	9.3	8.4	7.7	7.0	6.3	5.8	5.2	4.8	4.3	3.9	3.6
	Total	1281.3														
	T.P.Replace	119.8														
South	fuel(MUS$)	1926.1		922.6	128.4	120.2	112.6	105.4	98.7	92.4	86.6	81.0	75.9	71.1	66.5	62.3
	O&M(V)	516.7		247.5	34.4	32.3	30.2	28.3	26.5	24.8	23.2	21.7	20.4	19.1	17.8	16.7
	O&M(F)	118.9		80.9	10.9	9.9	9.0	8.2	7.5	6.8	6.2	5.6	5.1	4.6	4.2	3.8
	Total	2561.7												PhuMy#3	PhuMy#4	PM5,GC.1
														240	240	480
	T.P.Replace	190.2												13.754053	12.503684	22.733972
Central	fuel(MUS$)	40.5		19.4	2.7	2.5	2.4	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3
	O&M(V)	3.3		1.6	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	O&M(F)	4.1		2.8	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1
	Total	48.0														
	Gr.Total	4201.0														

Created 19 June 1995

(02) W/0 SonLa(GS) DM=Base

21th June not discoun discounted

		1993.0	Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
North	fuel(MUS$)	867.3		415.4	57.8	54.1	50.7	47.5	44.5	41.6	39.0	36.5	34.2	32.0	30.0	28.1
	O&M(V)	305.2		146.2	20.3	19.1	17.8	16.7	15.6	14.6	13.7	12.8	12.0	11.3	10.5	9.9
	O&M(F)	110.9		75.5	10.2	9.3	8.4	7.7	7.0	6.3	5.8	5.2	4.8	4.3	3.9	3.6
	Total	1283.4														
	T.P.Replace	123.0														
South	fuel(MUS$)	1899.5		909.9	126.6	118.6	111.0	104.0	97.4	91.2	85.4	79.9	74.8	70.1	65.6	61.4
	O&M(V)	494.1		236.7	32.9	30.8	28.9	27.0	25.3	23.7	22.2	20.8	19.5	18.2	17.1	16.0
	O&M(F)	148.0		100.7	13.6	12.4	11.2	10.2	9.3	8.5	7.7	7.0	6.3	5.8	5.2	4.8
	Total	2541.7												PhuMy#3	PhuMy#4	PhuMy#5
														240	240	240
	T.P.Replace	187.8												13.754053	12.503684	11.366986
Central	fuel(MUS$)	40.2		19.2	2.7	2.5	2.3	2.2	2.1	1.9	1.8	1.7	1.6	1.5	1.4	1.3
	O&M(V)	3.3		1.6	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1
	O&M(F)	4.1		2.8	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1
	Total	47.7														
	Gr.Total	4183.6														

Case - 01

2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043 yr
26.2	24.6	23.0	21.5	20.2	18.9	17.7	16.6	15.5	14.5	13.6	12.7	11.9	11.2	10.4	9.8	9.2	8.6
9.2	8.6	8.1	7.6	7.1	6.6	6.2	5.8	5.4	5.1	4.8	4.5	4.2	3.9	3.7	3.4	3.2	3.0
3.3	3.0	2.7	2.4	2.2	2.0	1.8	1.7	1.5	1.4	1.3	1.1	1.0	0.9	0.9	0.8	0.7	0.6
			Q.Ninh#1		Q.Ninh#2,3	Q.Ninh#4	Q.Ninh#5	Q.Ninh6,7	Q.N.8-10		Q.N.11,12	Q.N.13-15					
			375		750	375	375	750	1125		750	1125					
			12.130944	0	20.051147	9.1141579	8.2855981	15.064724	20.542805	0	11.31835	15.434114	0	0	0	0	0
58.3	54.6	51.1	47.9	44.8	42.0	39.3	36.8	34.5	32.3	30.2	28.3	26.5	24.8	23.2	21.8	20.4	19.1
15.6	14.7	13.7	12.8	12.0	11.3	10.5	9.9	9.2	8.7	8.1	7.6	7.1	6.7	6.2	5.8	5.5	5.1
3.5	3.2	2.9	2.6	2.4	2.2	2.0	1.8	1.6	1.5	1.3	1.2	1.1	1.0	0.9	0.8	0.8	0.7
									Coal#1,2	Coal#3-5	Coal#6-9	Coal#10-12				Phuly#3	
G.C/C#2	GasC/C#3	G.C/C#4,5	G.C/C#6,7						750	1125	1500	1125					240
240	240	480	480						13.695203	18.675277	22.6367	15.434114	0	0	0		2.0444523
10.333623	9.3942031	17.080369	15.527608	0	0	0	0										
1.2	1.1	1.1	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.4
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Case - 02

2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043 yr.
26.3	24.6	23.0	21.6	20.2	18.9	17.7	16.6	15.5	14.5	13.6	12.7	11.9	11.2	10.5	9.8	9.2	8.6
9.2	8.7	8.1	7.6	7.1	6.7	6.2	5.8	5.5	5.1	4.8	4.5	4.2	3.9	3.7	3.4	3.2	3.0
3.2	3.0	2.7	2.4	2.2	2.0	1.8	1.7	1.5	1.4	1.3	1.1	1.0	0.9	0.9	0.8	0.7	0.6
			Q.Ninh#1	Q.Ninh#2,3	Q.Ninh#4		Q.Ninh#5	Q.Ninh#6-8	Q.Ninh#9	Q.N.10,11	Q.Ninh#12	Q.N.#13-15					
			375	750	375		375	1125	375	750	375	1125					
			12.130944	22.056262	10.025574	0	8.2855981	22.587086	6.8476017	12.450185	5.659175	15.434114					
57.5	53.9	50.4	47.2	44.2	41.4	38.8	36.3	34.0	31.8	29.8	27.9	26.1	24.5	22.9	21.5	20.1	18.8
15.0	14.0	13.1	12.3	11.5	10.8	10.1	9.4	8.8	8.3	7.8	7.3	6.8	6.4	6.0	5.6	5.2	4.9
4.3	3.9	3.6	3.3	3.0	2.7	2.4	2.2	2.0	1.8	1.7	1.5	1.4	1.3	1.1	1.0	0.9	0.9
					Coal#1	Coal#2,3	Coal#4,5	Coal#7,8	Coal#8,9,1	Coal#11-13	Coal#14-17	Coal#18-20				Phuly#3	
					375	750	750	750	1125	1125	1500	1125					240
					10.025574	18.228316	16.571196	15.064724	20.542805	18.675277	22.6367	15.434114	0	0	0	0	2.0444523
1.2	1.1	1.1	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.4
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Case - 01

2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060 yr.
8.0	7.5	7.0	6.6	6.2	5.8	5.4	5.1	4.7	4.4	4.2	3.9	3.6	3.4	3.2	3.0	2.8
2.8	2.6	2.5	2.3	2.2	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0
0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1
										Q.Ninh#1		Q.Ninh#2,3	Q.Ninh#4	Q.Ninh#5	Q.Ninh6,7	Q,N.8-10
										375		750	375	375	750	1125
0	0	0	0	0	0	0	0	0	0	1.1196376	0	1.8506407	0.8412003	0.7647275	1.3904137	1.8960187
17.9	16.7	15.7	14.7	13.7	12.9	12.0	11.3	10.6	9.9	9.3	8.7	8.1	7.6	7.1	6.7	6.2
4.8	4.5	4.2	3.9	3.7	3.4	3.2	3.0	2.8	2.7	2.5	2.3	2.2	2.0	1.9	1.8	1.7
0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1
PhuMy#4	PM5,GC.1	G.C/C#2	GasC/C#3	G.C/C#4,5	G.C/C#6,7	G.C/C#9,10										Coal#1,2
240	480	240	240	480	480	480										750
1.858593	3.37926	1.5360273	1.3963884	2.5388881	2.3080801	2.0982546										1.2640125
0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Case - 02

2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060 yr
8.0	7.5	7.1	6.6	6.2	5.8	5.4	5.1	4.8	4.5	4.2	3.9	3.7	3.4	3.2	3.0	2.8
2.8	2.6	2.5	2.3	2.2	2.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0
0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1
										Q.Ninh#1	Q.Ninh#2,3	Q.Ninh#4		Q.Ninh#5	Q.Ninh#6-8	Q.Ninh#9
										375	750	375		375	1125	375
										1.1196376	2.0357047	0.9253203	0	0.7647275	2.0856206	0.6320062
17.6	16.5	15.4	14.5	13.5	12.7	11.9	11.1	10.4	9.7	9.1	8.5	8.0	7.5	7.0	6.6	6.2
4.6	4.3	4.0	3.8	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	1.9	1.8	1.7	1.6
0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2
PhuMy#4	PhuMy#5											Coal#1	Coal#2,3	Coal#4,5	Coal#7,8	Coal#8,9,10
240	240											375	750	750	750	1125
1.858593	1.68963	0	0	0	0	0	0	0				0.9253203	1.6824006	1.5294551	1.3904137	1.8960187
0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Variable cost (2014-2060)

⑤ Case-SL/GL DM=High 27th June not discoun discounted

		1993	Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	yr.
North	fuel(MUS$)	384.4		184.1	25.6	24.0	22.5	21.0	19.7	18.4	17.3	16.2	15.1	14.2	13.3	12.4	
	O&M(V)	134.7		64.5	9.0	8.4	7.9	7.4	6.9	6.5	6.1	5.7	5.3	5.0	4.7	4.4	
	O&M(F)	92.2		62.8	8.5	7.7	7.0	6.4	5.8	5.3	4.8	4.4	4.0	3.6	3.3	3.0	
	Total	611.4															
	T.P.Replace	91.8															
South	fuel(MUS$)	2323.8		1113.1	154.9	145.1	135.8	127.2	119.1	111.5	104.4	97.8	91.6	85.7	80.3	75.2	
	O&M(V)	618.0		296.0	41.2	38.6	36.1	33.8	31.7	29.7	27.8	26.0	24.3	22.8	21.3	20.0	
	O&M(F)	143.8		97.8	13.2	12.0	10.9	9.9	9.0	8.2	7.5	6.8	6.2	5.6	5.1	4.6	
	Total	3085.6											PhuMy#3	PhuMy#4	P5,GC#1	P5,GC#2,3	
													240	240	480	480	
	T.P.Replace	238.0											15.129458	13.754053	25.007369	22.733872	
Central	fuel(MUS$)	27.5		13.2	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	0.9	0.9	
	O&M(V)	2.3		1.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
	O&M(F)	4.1		2.8	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	
	Total	33.9															
	Gr.Total	4060.7															

⑦ Case-SS/GL DM=High 27th June not discoun discounted

		1993.0	year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	yr.
North	fuel(MUS$)	545.7		261.4	36.4	34.1	31.9	29.9	28.0	26.2	24.5	23.0	21.5	20.1	18.9	17.7	
	O&M(V)	191.6		91.8	12.8	12.0	11.2	10.5	9.8	9.2	8.6	8.1	7.5	7.1	6.6	6.2	
	O&M(F)	92.2		62.8	8.5	7.7	7.0	6.4	5.8	5.3	4.8	4.4	4.0	3.6	3.3	3.0	
	Total	829.5															
	T.P.Replace	100.8															
South	fuel(MUS$)	2321.0		1111.8	154.7	144.9	135.7	127.0	119.0	111.4	104.3	97.7	91.4	85.6	80.2	75.1	
	O&M(V)	617.1		295.6	41.1	38.5	36.1	33.8	31.6	29.6	27.7	26.0	24.3	22.8	21.3	20.0	
	O&M(F)	143.8		97.8	13.2	12.0	10.9	9.9	9.0	8.2	7.5	6.8	6.2	5.6	5.1	4.6	
	Total	3081.9											PhuMy#3	PhuMy#4	P5,GC1	GC/C#2,3	
													240	240	480	480	
	T.P.Replace	235.1											15.129458	13.754053	25.007369	22.733872	
Central	fuel(MUS$)	29.1		14.0	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0	0.9	
	O&M(V)	2.4		1.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
	O&M(F)	4.1		2.8	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	
	Total	35.7															
	Gr.Total	4283.1															

Case ⑤

2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
11.6	10.9	10.2	9.6	9.0	8.4	7.8	7.3	6.9	6.4	6.0	5.6	5.3	5.0	4.6	4.3	4.1	3.8
4.1	3.8	3.6	3.3	3.1	2.9	2.7	2.6	2.4	2.3	2.1	2.0	1.9	1.7	1.6	1.5	1.4	1.3
2.7	2.5	2.2	2.0	1.8	1.7	1.5	1.4	1.3	1.1	1.0	0.9	0.9	0.8	0.7	0.6	0.6	0.5
			Q.Ninh#1	Q.Ninh#2	Q.Ninh#3	Q.Ninh#4	Q.Ninh#5				Q.Ninh#6	Q.Ninh#6-12					
			375	375	375	375	375				375	2250					
			12.130944	11.028131	10.025574	9.1141579	8.2855981				5.659175	30.868227					
70.4	65.9	61.7	57.8	54.1	50.7	47.4	44.4	41.6	38.9	36.5	34.1	32.0	29.9	28.0	26.3	24.6	23.0
18.7	17.5	16.4	15.4	14.4	13.5	12.6	11.8	11.1	10.4	9.7	9.1	8.5	8.0	7.5	7.0	6.5	6.1
4.2	3.8	3.5	3.2	2.9	2.6	2.4	2.2	2.0	1.8	1.6	1.5	1.3	1.2	1.1	1.0	0.9	0.8
GC/C#4,5	GC/C#6,7						Coal#1	Coal#2,3	Coal#4-6	Coal#6-8	Coal#9-12	Coal#12-14				Phukty#3	Phukty#4
480	480						375	750	1125	1125	1500	1125				240	240
20.667247	18.788406						8.2855981	15.064724	20.542805	18.675277	22.6367	15.434114	0	0	0	2.2488975	2.0444523
0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3
0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Case ⑦

2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
16.5	15.5	14.5	13.6	12.7	11.9	11.1	10.4	9.8	9.1	8.6	8.0	7.5	7.0	6.6	6.2	5.8	5.4
5.8	5.4	5.1	4.8	4.5	4.2	3.9	3.7	3.4	3.2	3.0	2.8	2.6	2.5	2.3	2.2	2.0	1.9
2.7	2.5	2.2	2.0	1.8	1.7	1.5	1.4	1.3	1.1	1.0	0.9	0.9	0.8	0.7	0.6	0.6	0.5
			Q.Ninh#1	Q.Ninh#2	Q.Ninh#3	Q.Ninh#4,5	Q.Ninh#6	Q.Ninh#7		Q.Ninh#8	Q.Ninh#9	Q.Ninh#10-12					
			375	375	375	750	375	375		375	375	1125					
			12.130944	11.028131	10.025574	18.228316	8.2855981	7.5323619		6.2250925	5.659175	15.434114					
70.3	65.8	61.6	57.7	54.0	50.6	47.4	44.4	41.5	38.9	36.4	34.1	31.9	29.9	28.0	26.2	24.5	23.0
18.7	17.5	16.4	15.3	14.4	13.5	12.6	11.8	11.0	10.3	9.7	9.1	8.5	8.0	7.4	7.0	6.5	6.1
4.2	3.8	3.5	3.2	2.9	2.6	2.4	2.2	2.0	1.8	1.6	1.5	1.3	1.2	1.1	1.0	0.9	0.8
GC/C#4	GC/C#5,6	GC/C#7						Coal#1-3	Coal#4-6	Coal#7-9	Coal#10-13	Coal#14-16				Phukty#3	Phukty#4
240	480	240						1125	1125	1125	1500	1125				240	240
10.333623	18.788406	8.5401847						22.597086	20.542805	18.675277	22.6367	15.434114	0	0	0	2.2488975	2.0444523
0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3
0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Case ⑤

2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060 yr.
3.6	3.3	3.1	2.9	2.7	2.6	2.4	2.3	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2
1.2	1.2	1.1	1.0	1.0	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.4
0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1
										Q.Ninh#1	Q.Ninh#2	Q.Ninh#3	Q.Ninh#4	Q.Ninh#5		
										375	375	375	375	375		
										1.1196376	1.0178524	0.9253203	0.8412003	0.7647275		
21.6	20.2	18.9	17.7	16.6	15.5	14.5	13.6	12.7	11.9	11.2	10.5	9.8	9.2	8.6	8.0	7.5
5.7	5.4	5.0	4.7	4.4	4.1	3.9	3.6	3.4	3.2	3.0	2.8	2.6	2.4	2.3	2.1	2.0
0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2
P5,GC#1	P5,GC#2,3	GC/C#4,5	GC/C#6,7											Coal#1	Coal#2,3	Coal#4-6
480	480	480	480											375	750	1125
3.717186	3.37926	3.0720546	2.7927769											0.7647275	1.3904137	1.8960187
0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Case ⑦

2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060 yr
5.1	4.7	4.4	4.2	3.9	3.6	3.4	3.2	3.0	2.8	2.6	2.5	2.3	2.2	2.0	1.9	1.8
1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.6
0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1
										Q.Ninh#1	Q.Ninh#2	Q.Ninh#3	Q.Ninh#4,5	Q.Ninh#6	Q.Ninh#7	
										375	375	375	750	375	375	
										1.1196376	1.0178524	0.9253203	1.6824006	0.7647275	0.6952069	
21.5	20.2	18.9	17.7	16.5	15.5	14.5	13.6	12.7	11.9	11.2	10.4	9.8	9.2	8.6	8.0	7.5
5.7	5.4	5.0	4.7	4.4	4.1	3.9	3.6	3.4	3.2	3.0	2.8	2.6	2.4	2.3	2.1	2.0
0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2
P5,GC1	GC/C#2,3	GC/C#4	GC/C#5,6	GC/C#7											Coal#1-3	Coal#4-6
480	480	240	480	240						0	0	0	0	0	1125	1125
3.717186	3.37926	1.5360273	2.7927769	1.269444											2.0856206	1.8960187
0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

⑥ Case-SL/GS

DM=High 23rd June not discoun discounted

		1993.0	year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Yr.
North	fuel(MUS$)	390.4		187.0	26.0	24.4	22.8	21.4	20.0	18.7	17.5	16.4	15.4	14.4	13.5	12.6	
	O&M(V)	136.0		65.2	9.1	8.5	8.0	7.4	7.0	6.5	6.1	5.7	5.4	5.0	4.7	4.4	
	O&M(F)	92.2		62.8	8.5	7.7	7.0	6.4	5.8	5.3	4.8	4.4	4.0	3.6	3.3	3.0	
	Total	618.7															
	T.P.Replace	100.1															
South	fuel(MUS$)	2273.8		1089.2	151.6	141.9	132.9	124.5	116.5	109.1	102.2	95.7	89.6	83.9	78.5	73.5	
	O&M(V)	589.9		282.6	39.3	36.8	34.5	32.3	30.2	28.3	26.5	24.8	23.2	21.8	20.4	19.1	
	O&M(F)	160.5		109.2	14.8	13.4	12.2	11.1	10.1	9.2	8.3	7.6	6.9	6.3	5.7	5.2	
	Total	3024.2											PhuMy#3	PhuMy#4,5			
													240	480			
	T.P.Replace	217.7											15.129458	27.508106			
Central	fuel(MUS$)	45.0		21.5	3.0	2.8	2.6	2.5	2.3	2.2	2.0	1.9	1.8	1.7	1.6	1.5	
	O&M(V)	3.7		1.8	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	
	O&M(F)	4.1		2.8	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	
	Total	52.9															
	Gr.Total	4013.6															

⑧ Case-SS/GS

DM=High 24th June not discoun discounted

		1993.0	year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	Yr
North	fuel(MUS$)	532.6		255.1	35.5	33.2	31.1	29.1	27.3	25.6	23.9	22.4	21.0	19.6	18.4	17.2	
	O&M(V)	186.8		89.5	12.5	11.7	10.9	10.2	9.6	9.0	8.4	7.9	7.4	6.9	6.5	6.0	
	O&M(F)	92.3		62.8	8.5	7.7	7.0	6.4	5.8	5.3	4.8	4.4	4.0	3.6	3.3	3.0	
	Total	811.7															
	T.P.Replace	107.0															
South	fuel(MUS$)	2268.9		1086.8	151.3	141.6	132.6	124.2	116.3	108.9	102.0	95.5	89.4	83.7	78.4	73.4	
	O&M(V)	586.5		281.9	39.2	36.7	34.4	32.2	30.2	28.2	26.4	24.8	23.2	21.7	20.3	19.0	
	O&M(F)	160.5		109.2	14.8	13.4	12.2	11.1	10.1	9.2	8.3	7.6	6.9	6.3	5.7	5.2	
	Total	3017.9											PhuMy#3	PhuMy#4,5			
													240	480			
	T.P.Replace	209.5											15.129458	27.508106	0		
Central	fuel(MUS$)	48.9		23.4	3.3	3.0	2.9	2.7	2.5	2.3	2.2	2.1	1.9	1.8	1.7	1.6	
	O&M(V)	4.0		1.9	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	
	O&M(F)	4.1		2.8	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	
	Total	56.9															
	Gr.Total	4203.0															

Case ⑥

2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	yr.
11.8	11.1	10.4	9.7	9.1	8.5	8.0	7.5	7.0	6.5	6.1	5.7	5.4	5.0	4.7	4.4	4.1	3.9	
4.1	3.9	3.6	3.4	3.2	3.0	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.6	1.5	1.4	1.3	
2.7	2.5	2.2	2.0	1.8	1.7	1.5	1.4	1.3	1.1	1.0	0.9	0.9	0.8	0.7	0.6	0.6	0.5	
			Q.Ninh#1,2	Q.Ninh#3	Q.Ninh#4	Q.Ninh#5		Q.Ninh#6		Q.Ninh#7	Q.Ninh#8	Q.Ninh#9-12						
			750	375	375	375		375		375	375	1500						
			24.261888	11.028131	10.025574	9.1141579		7.5323619		6.2250825	5.659175	20.578818						
68.9	64.5	60.4	56.5	52.9	49.6	46.4	43.5	40.7	38.1	35.7	33.4	31.3	29.3	27.4	25.7	24.1	22.5	
17.9	16.7	15.7	14.7	13.7	12.9	12.0	11.3	10.6	9.9	9.3	8.7	8.1	7.6	7.1	6.7	6.2	5.8	
4.7	4.3	3.9	3.5	3.2	2.9	2.7	2.4	2.2	2.0	1.8	1.6	1.5	1.4	1.2	1.1	1.0	0.9	
				Coal#1,2	Coal#3	Coal#4,5	Coal#6,7	Coal#8,9	Coal#10-12	Coal#13-15	Coal#16-19	Coal#20-22				Phuly#3	Phuly#4,5	
				750	375	750	750	750	1125	1125	1500	1125				240	480	
				22.056262	10.025574	18.228316	16.571196	15.064724	20.542805	18.675277	22.6367	15.434114	0	0	0	2.2488975	4.0889046	
1.4	1.3	1.2	1.1	1.0	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.4	
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Case ⑧

2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	yr
16.1	15.1	14.1	13.2	12.4	11.6	10.9	10.2	9.5	8.9	8.4	7.8	7.3	6.9	6.4	6.0	5.6	5.3	
5.7	5.3	5.0	4.6	4.4	4.1	3.8	3.6	3.3	3.1	2.9	2.7	2.6	2.4	2.3	2.1	2.0	1.9	
2.7	2.5	2.2	2.0	1.8	1.7	1.5	1.4	1.3	1.1	1.0	0.9	0.9	0.8	0.7	0.6	0.6	0.5	
			Q.Ninh#1	Q.Ninh#2,3	Q.Ninh#4	Q.Ninh#5	Q.Ninh#6	Q.Ninh#7,8		Q.Ninh#9,1	Q.Ninh#11	Q.Ninh#12						
			375	750	375	375	375	750		750	375	375						
			12.130944	22.056262	10.025574	9.1141579	8.2855981	15.064724	0	12.450185	5.659175	5.1447045						
68.7	64.3	60.3	56.4	52.8	49.5	46.3	43.4	40.6	38.0	35.6	33.3	31.2	29.2	27.4	25.6	24.0	22.5	
17.8	16.7	15.6	14.6	13.7	12.8	12.0	11.2	10.5	9.9	9.2	8.6	8.1	7.6	7.1	6.6	6.2	5.8	
4.7	4.3	3.9	3.5	3.2	2.9	2.7	2.4	2.2	2.0	1.8	1.6	1.5	1.4	1.2	1.1	1.0	0.9	
				Coal#1	Coal#2,3	Coal#4,5	Coal#6,7	Coa#18	Coal#9-12	CL#13-15	CL#16-19	CL#20-22						
				375	750	750	750	375	1500	1125	1500	1125						
				11.028131	20.051147	18.228316	16.571196	7.5323619	27.390407	18.675277	22.6367	15.434114	0	0	0	0	0	
1.5	1.4	1.3	1.2	1.1	1.1	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.5	
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Case ⑥

2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	yr.
3.6	3.4	3.2	3.0	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8	1.6	1.5	1.4	1.4	1.3	
1.3	1.2	1.1	1.0	1.0	0.9	0.9	0.8	0.7	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.4	
0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	
										Q.Ninh#1,2	Q.Ninh#3	Q.Ninh#4	Q.Ninh#5		Q.Ninh#6		
										750	375	375	375		375		
										2.2392752	1.0178524	0.9253203	0.8412003		0.6952069		
21.1	19.7	18.5	17.3	16.2	15.2	14.2	13.3	12.5	11.7	10.9	10.2	9.6	9.0	8.4	7.9	7.4	
5.5	5.1	4.8	4.5	4.2	3.9	3.7	3.5	3.2	3.0	2.8	2.7	2.5	2.3	2.2	2.0	1.9	
0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	
											Coal#1,2	Coal#3	Coal#4,5	Coal#6,7	Coal#8,9	Coal#10-12	
											750	375	750	750	750	1125	
		0	0	0	0	0	0	0	0	0	2.0357047	0.9253203	1.6824006	1.5294551	1.3904137	1.8960187	
0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Case ⑧

2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	yr.
4.9	4.6	4.3	4.1	3.8	3.6	3.3	3.1	2.9	2.7	2.6	2.4	2.2	2.1	2.0	1.8	1.7	
1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	1.0	0.9	0.8	0.8	0.7	0.7	0.6	0.6	
0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	
										Q.Ninh#1	Q.Ninh#2,3	Q.Ninh#4	Q.Ninh#5	Q.Ninh#6	Q.Ninh#7,8		
										375	750	375	375	375	750		
										1.1196376	2.0357047	0.9253203	0.8412003	0.7647275	1.3904137	0	
21.0	19.7	18.4	17.3	16.2	15.1	14.2	13.3	12.4	11.6	10.9	10.2	9.6	9.0	8.4	7.8	7.3	
5.5	5.1	4.8	4.5	4.2	3.9	3.7	3.4	3.2	3.0	2.8	2.6	2.5	2.3	2.2	2.0	1.9	
0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	
											Coal#1	Coal#2,3	Coal#4,5	Coal#6,7	Coa#18	Coal#9-12	
											375	750	750	750	375	1500	
0	0	0	0	0	0	0	0	0	0	0	1.0178524	1.8506407	1.6824006	1.5294551	0.6952069	2.5280249	
0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Variable cost (2014-2060)

⑨ Case-SL/GS(2009)

		1993	27th June not discoun year 2013	discounted 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	yr
North	fuel(MUS$)	387.9	185.8	25.9	24.2	22.7	21.2	19.9	18.6	17.4	16.3	15.3	14.3	13.4	12.5	
	O&M(V)	135.1	64.7	9.0	8.4	7.9	7.4	6.9	6.5	6.1	5.7	5.3	5.0	4.7	4.4	
	O&M(F)	79.8	54.3	7.3	6.7	6.1	5.5	5.0	4.6	4.1	3.8	3.4	3.1	2.8	2.6	
	Total	602.8														
	T.P.Replace	91.4														
South	fuel(MUS$)	1878.6	899.8	125.2	117.3	109.8	102.8	96.3	90.2	84.4	79.0	74.0	69.3	64.9	60.8	
	O&M(V)	489.2	234.3	32.6	30.5	28.6	26.8	25.1	23.5	22.0	20.6	19.3	18.0	16.9	15.8	
	O&M(F)	129.3	88.0	11.9	10.8	9.8	8.9	8.1	7.4	6.7	6.1	5.5	5.0	4.6	4.2	
	Total	2497.1											Phuky#3,4 480 27.508106		Phuky#5 240 11.366986	
	T.P.Replace	175.2														
Central	fuel(MUS$)	28.4	13.6	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.0	1.0	0.9	
	O&M(V)	2.4	1.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
	O&M(F)	4.1	2.8	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	
	Total	34.9														
	Gr.Total	3401.4														

⑩ Case-SS/GS(2009)

		1993.0	26th June not discoun year 2013	discounted 2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	yr
North	fuel(MUS$)	531.5	254.6	35.4	33.2	31.1	29.1	27.2	25.5	23.9	22.4	20.9	19.6	18.4	17.2	
	O&M(V)	186.6	89.4	12.4	11.7	10.9	10.2	9.6	9.0	8.4	7.9	7.4	6.9	6.4	6.0	
	O&M(F)	98.5	67.0	9.1	8.2	7.5	6.8	6.2	5.6	5.1	4.6	4.2	3.8	3.5	3.2	
	Total	816.6														
	T.P.Replace	110.4														
South	fuel(MUS$)	1877.3	899.2	125.2	117.2	109.7	102.8	96.2	90.1	84.4	79.0	74.0	69.3	64.8	60.7	
	O&M(V)	488.9	234.2	32.6	30.5	28.6	26.8	25.1	23.5	22.0	20.6	19.3	18.0	16.9	15.8	
	O&M(F)	129.3	88.0	11.9	10.8	9.8	8.9	8.1	7.4	6.7	6.1	5.5	5.0	4.6	4.2	
	Total	2495.5											Phuky#3,4 480 27.508106	Phuky#5 240 12.503684		
	T.P.Replace	175.7														
Central	fuel(MUS$)	29.1	13.9	1.9	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1	1.1	1.0	0.9	
	O&M(V)	2.4	1.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
	O&M(F)	4.1	2.8	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	
	Total	35.6														
	Gr.Total	3634.0														

Case ⑨

2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	yr
11.7	11.0	10.3	9.6	9.0	8.5	7.9	7.4	6.8	6.5	6.1	5.7	5.3	5.0	4.7	4.4	4.1	3.8	
4.1	3.8	3.6	3.4	3.1	2.9	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.7	1.6	1.5	1.4	1.3	
2.3	2.1	1.9	1.8	1.6	1.5	1.3	1.2	1.1	1.0	0.9	0.8	0.7	0.7	0.6	0.6	0.5	0.5	
			Q.Ninh#1,2		Q.Ninh#3	Q.Ninh#4,5	Q.Ninh#6,7				Q.Ninh#8	Q.Ninh#9,10						
			750		375	750	750				375	750						
			24.261888		10.025574	18.228316	16.571196				5.659175	10.289409						
56.9	53.3	49.9	46.7	43.7	41.0	38.3	35.9	33.6	31.5	29.5	27.6	25.8	24.2	22.7	21.2	19.9	18.6	
14.8	13.9	13.0	12.2	11.4	10.7	10.0	9.4	8.8	8.2	7.7	7.2	6.7	6.3	5.9	5.5	5.2	4.8	
3.8	3.4	3.1	2.8	2.6	2.4	2.1	1.9	1.8	1.6	1.5	1.3	1.2	1.1	1.0	0.9	0.8	0.7	
				Coal#1		Coal#2,3	Coal#4,5	Coal#6-8	Coal#9,10	Coal#11-13	Coal#14-16	Coal#17					Phuly#3,4	
				375		750	750	1125	750	1125	1125	375					480	
				11.028131		18.228316	16.571196	22.597086	13.695203	18.675277	16.977525	5.1447045	0	0	0		4.0889046	
0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	
0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Case ⑩

2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	yr
16.1	15.1	14.1	13.2	12.4	11.6	10.9	10.2	9.5	8.9	8.3	7.8	7.3	6.8	6.4	6.0	5.6	5.3	
5.7	5.3	5.0	4.6	4.3	4.1	3.8	3.6	3.3	3.1	2.9	2.7	2.6	2.4	2.3	2.1	2.0	1.8	
2.9	2.6	2.4	2.2	2.0	1.8	1.6	1.5	1.3	1.2	1.1	1.0	0.9	0.8	0.8	0.7	0.6	0.6	
			Q.Ninh#1,2		Q.Ninh#3	Q.Ninh#4,5	Q.Ninh#6,7	Q.Ninh#8			Q.Ninh#9,1	Q.Ninh#11-13						
			750		375	750	750	375			750	1125						
			24.261888		10.025574	18.228316	16.571196	7.5323619			11.31835	15.434114						
56.9	53.2	49.9	46.7	43.7	40.9	38.3	35.9	33.6	31.5	29.5	27.6	25.8	24.2	22.6	21.2	19.9	18.6	
14.8	13.9	13.0	12.2	11.4	10.7	10.0	9.3	8.7	8.2	7.7	7.2	6.7	6.3	5.9	5.5	5.2	4.8	
3.8	3.4	3.1	2.8	2.6	2.4	2.1	1.9	1.8	1.6	1.5	1.3	1.2	1.1	1.0	0.9	0.8	0.7	
				Coal#1		Coal#2,3	Coal#4,5	Coal#6,7	Coal#8-10	Coal#11-13	Coal#14-16	Coal#17					Phuly#3,4	
				375		750	750	750	1125	1125	1125	375					480	
				11.028131		18.228316	16.571196	15.064724	20.542805	18.675277	16.977525	5.1447045	0	0	0		4.0889046	
0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3	
0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Case ⑨

2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
3.6	3.4	3.2	3.0	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.7	1.6	1.5	1.4	1.3	1.3
1.3	1.2	1.1	1.0	1.0	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.4
0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
										Q.Ninh#1,2		Q.Ninh#3	Q.Ninh#4,5	Q.Ninh#6,7		
										750		375	750	750		
										2.2392752		0.9253203	1.6824006	1.5294551		
17.4	16.3	15.3	14.3	13.4	12.5	11.7	11.0	10.3	9.6	9.0	8.5	7.9	7.4	6.9	6.5	6.1
4.5	4.2	4.0	3.7	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	1.9	1.8	1.7	1.6
0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1
	PhuMy#5										Coal#1		Coal#2,3	Coal#4,5	Coal#6-8	Coal#9,10
	240										375		750	750	1125	750
	1.68963										1.0178524		1.6824006	1.5294551	2.0856206	1.2640125
0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Case ⑩

2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
4.9	4.6	4.3	4.0	3.8	3.5	3.3	3.1	2.9	2.7	2.6	2.4	2.2	2.1	2.0	1.8	1.7
1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	1.0	0.9	0.8	0.8	0.7	0.7	0.6	0.6
0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
										Q.Ninh#1,2		Q.Ninh#3	Q.Ninh#4,5	Q.Ninh#6,7	Q.Ninh#8	
										750		375	750	750	375	
										2.2392752		0.9253203	1.6824006	1.5294551	0.6852069	
17.4	16.3	15.3	14.3	13.4	12.5	11.7	11.0	10.3	9.6	9.0	8.4	7.9	7.4	6.9	6.5	6.1
4.5	4.2	4.0	3.7	3.5	3.3	3.1	2.9	2.7	2.5	2.3	2.2	2.1	1.9	1.8	1.7	1.6
0.7	0.6	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1
PhuMy#5											Coal#1		Coal#2,3	Coal#4,5	Coal#6,7	Coal#8-10
240											375		750	750	750	1125
1.858593										0	1.0178524		1.6824006	1.5294551	1.3904137	1.8960187
0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Variable cost (2014-2060)

(11) Case-SS/GS, LOLP=3.0%

			27th June not discoun	discounted											
		1993.0	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
North	fuel(MUS$)	472.4	226.3	31.5	29.5	27.6	25.9	24.2	22.7	21.2	19.9	18.6	17.4	16.3	15.3
	O&M(V)	160.7	77.0	10.7	10.0	9.4	8.8	8.2	7.7	7.2	6.8	6.3	5.9	5.6	5.2
	O&M(F)	73.6	50.1	6.8	6.2	5.6	5.1	4.6	4.2	3.8	3.5	3.2	2.9	2.6	2.4
	Total	706.7													
	T.P.Replace	75.6													
South	fuel(MUS$)	1869.0	895.2	124.6	116.7	109.2	102.3	95.8	89.7	84.0	78.6	73.6	68.9	64.6	60.5
	O&M(V)	485.4	232.5	32.4	30.3	28.4	26.6	24.9	23.3	21.8	20.4	19.1	17.9	16.8	15.7
	O&M(F)	123.1	83.8	11.3	10.3	9.4	8.5	7.7	7.0	6.4	5.8	5.3	4.8	4.4	4.0
	Total	2477.5												PhuMy#3,4	PhuMy#5
														480	240
	T.P.Replace	159.0											0	25.007369	11.366986
Central	fuel(MUS$)	73.9	35.4	4.9	4.6	4.3	4.0	3.8	3.5	3.3	3.1	2.9	2.7	2.6	2.4
	O&M(V)	6.2	2.9	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2
	O&M(F)	4.1	2.8	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1
	Total	84.1													
	Gr.Total	3503.0													

yr.

Case (11)

Year	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043 yr
	14.3	13.4	12.5	11.7	11.0	10.3	9.6	9.0	8.5	7.9	7.4	6.8	6.5	6.1	5.7	5.3	5.0	4.7
	4.9	4.6	4.3	4.0	3.7	3.5	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2.1	1.9	1.8	1.7	1.6
	2.2	2.0	1.8	1.6	1.5	1.3	1.2	1.1	1.0	0.9	0.8	0.8	0.7	0.6	0.6	0.5	0.5	0.4
					Q.Ninh#1	Q.Ninh#2,3	Q.Ninh#4		Q.Ninh#5	Q.Ninh#6		Q.Ninh#7	Q.Ninh#8,9					
					375	750	375		375	375		375	750					
					11.028131	20.051147	9.1141579		7.5323619	6.8476017		5.659175	10.289409					
	56.6	53.0	49.6	46.5	43.5	40.7	38.2	35.7	33.5	31.3	29.3	27.5	25.7	24.1	22.5	21.1	19.8	18.5
	14.7	13.8	12.9	12.1	11.3	10.6	9.9	9.3	8.7	8.1	7.6	7.1	6.7	6.3	5.9	5.5	5.1	4.8
	3.6	3.3	3.0	2.7	2.5	2.2	2.0	1.9	1.7	1.5	1.4	1.3	1.1	1.0	0.9	0.9	0.8	0.7
						Coal#1	Coal#2,3	Coal#4	Coal#5,6	Coal#7,8	Coal#9-11	Coal#12-14	Coal#15,16					
						375	750	375	750	750	1125	1125	750					
	0	0	0	0	0	10.025574	18.228316	8.2855981	15.064724	13.695203	18.675277	16.977525	10.289409					
	2.2	2.1	2.0	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.2	1.1	1.0	1.0	0.9	0.8	0.8	0.7
	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Case (11)

Year	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	Yr
	4.4	4.1	3.8	3.6	3.4	3.2	3.0	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.7	1.6	1.5	
	1.5	1.4	1.3	1.2	1.1	1.1	1.0	0.9	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5	
	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
												Q.Ninh#1	Q.Ninh#2,3	Q.Ninh#4		Q.Ninh#5	Q.Ninh#6	
												375	750	375		375	375	
												1.0178524	1.8506407	0.8412003		0.6952069	0.5320062	
	17.3	16.2	15.2	14.2	13.3	12.5	11.7	10.9	10.2	9.6	9.0	8.4	7.9	7.4	6.9	6.5	6.1	
	4.5	4.2	3.9	3.7	3.5	3.2	3.0	2.8	2.7	2.5	2.3	2.2	2.0	1.9	1.8	1.7	1.6	
	0.6	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	
	Phuly#3,4	Phuly#5											Coal#1	Coal#2,3	Coal#4	Coal#5,6	Coal#7,8	
	480	240											375	750	375	750	750	
	3.717186	1.68963											0.9253203	1.6824006	0.7647275	1.3904137	1.2640125	
	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.2	
	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

CHAPTER 10

POWER SYSTEM EXTENSION PLAN

CHAPTER 10 POWER SYSTEM EXTENSION PLAN

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10.1 Power System Planning in the Fourth Master Plan Study

Particulars of the 220kV system extension plans for transmission lines and substations of each region of northern, southern and central in the fourth M/P are presented in Tables 10.2 through 10.7, together with proposed additions and revisions in this study according to the results of the power system analysis.

10.2 Power System Analysis

(1) Methods of Power System Analysis

The power systems of the overall Vietnamese 500/220kV transmission networks in 2000, 2005 and 2010 were analyzed with power flow calculation.

(2) Conditions of the Analysis

- Assumed power systems: The 2000 and 2005 power systems were basically based on the power systems in the fourth M/P, with some proposed modifications according to implementation schedules of power projects. The proposed 500kV systems are added as deemed necessary in the study. The 2010 power system was composed by adding 500kV and 220kV systems as deemed necessary according to the results of power flow calculations.

- Substation loads: In chapter 5 of Vol II, Annex 5, only sales energy in GWh of each province was estimated. The MW demand of each province at the 220kV buses was obtained by assuming the load factor of each region and T&D loss up to the 220kV outgoing points. The 220kV substation loads were estimated for the base case scenario taking into account local conditions.

  Assumed outputs of power stations connected to the 110kV system such as Thac Ba, Thac Mo, Buon Coup, etc. were deducted from the estimated 220kV loads. The estimated substation loads of all the substations of each region are tabulated in Table 10.1.

- Assumed load power factor: Power factor of all the substation loads was assumed to be 90% at the outgoing points from 220kV buses.

- Maximum transformer capacity: The transformer capacity of substations in the Hanoi and Ho Chi Minh areas is estimated to grow large in near future. An appropriate maximum demand of one substation is assumed to be 400 to 450MW with two 250MVA units or four 125MVA transformers. In the power flow analysis, allocation of load was assumed only at the existing and planned substation sites. Construction of new substations was also judged necessary and taken into account in estimating necessary fund for future extension.

- Power sources: Locations and output of new power stations were determined according the result of the power development study of this M/P study for the Son La small and gas small (Case SS/GS) development case.

The power flow analyses were conducted for the cases of rainy season, when hydropower plants are fully operated, and of dry season, when thermal power plants are fully operated. The maximum sending out power was assumed to be 95% of the rated output for hydropower plants and 90% of the rated output for thermal power plants.

(3) Results of Power Flow Calculations

The results of power flow calculations were drawn for each of northern (Figures 10.1 to 10.4), southern (Figures 10.5 to 10.8) and central power systems (Figures 10.9 to 10.12) as per attached.

(4) Findings in Power Flow Calculations

Findings from the results of power flow studies are mentioned below:

(a) Northern System

- The 220kV system extension plan in the fourth M/P up to 2005 seems to be prepared with enough allowance and basically no addition will be required except the followings up to 2010. Comments on the extension plan up to 2010 are mentioned below:

  - Second circuit is required for the section of Nho Quan - Ninh Binh - Nam Dinh - Thai Binh - Hai Phong in the period of 2000 to 2005 due to implementation of Ban Mai in 2004. In future after 2010, this system will require reinforcement by feeding the 500kV power at around Nam Dinh. The second circuit of the Hoa Binh - Nho Quan line, which is at present connected to the Thanh Hoa line, shall be connected to this line.

  - Installation of the Ha Tinh 500/220kV transformer is required just after 2000 to attain stable operation of the 220kV system extended to Dong Hoi. In relation to these developments, the second circuit shall be strung on the existing double circuit towers of the Thanh Hoa - Vinh - Ha Tinh section.

  - The construction schedules of the second Pha Lai - Hoang Bo line and Ban Mai - Vinh line were shifted from 2001 - 2005 to 2006 - 2010 based on the power development plan.

  - For delivery of the Dai Thi power, two single circuit lines, Dai Thi to Yen Bai and to Thai Nguyen, were taken into account.

  - When the 500kV Hanoi north substation starts its operation near Da Phuoc, the 220kV Da Phuoc - Chem line is recommended to be constructed

  - For power supply to the Hanoi area, one additional substation will be required around the year of 2010.

- For delivery of the Son La power, the 500kV system is surely required. The power plant is more than 250km away from the major demand centers of Hanoi and Hai Phong. Therefore, the 220kV system is not appropriate to send the generated Son La power. The 500kV system up to 2010 was planned from the following considerations:

- For connection with the 220kV system at the Son La site one 500/220kV transformer is required.

- For delivery of the Son La power, two 500kV lines are considered, one toward the south of Hanoi and the other toward the north side, forming a loop circuit by connecting both at Hai Phong. Two circuit line is considered between Son La and Hoa Binh south and single circuit lines for all the other sections.

- The second circuit will be necessary for the Hoa Binh south - Hanoi south - Hai Phong section when the Son La and Huoi Quang projects are fully developed and demand of the Hanoi and Hai Phong areas grows further.

- A switching substation is planned to the south of Hoa Binh for connection with the existing line. The existing Hoa Binh substation site is not suitable for large extension due to limitation of available land. Three transformer stations for stepping down to 220kV are taken into account. In the system analysis, substation locations are assumed at Mai Dong (south of Hanoi), at Da Phuoc (north of Hanoi) and at Hai Phong.

- 500kV connection to Nam Dinh will be required after 2010 when maintenance of the normal supply voltage only by the 220kV double circuit line becomes difficult around this point.

- 500kV system extension to Hoang Bo had better be studied in case that the thermal development in the Quan Ninh area exceed the 1500MW level.

(b) Southern System

- In the southern system, demand is heavily concentrated in the Ho Chi Minh area. Together with Dong Nai province, this area has consumed approximately two thirds of all consumption in the southern system. Due to large growth in demand, careful study is required in estimating future power flow. Many existing facilities will require reinforcement or replacement by 2010 due to large growth in power flow. Major comments to the 220kV system are as follows:

  - As very large development is planned at the Phu My and Phan Thiet (4,200MW in total by 2010), large power flow is expected in the section of Phu My - Cat Lai - Thu Duc. Conductors not smaller than 2 x 330 sq. mm seems advisable.

  - The power to Tao Dan in the center of Ho Chi Minh city had better be sent from Cat Lai instead of the planned Phu Lam. The power flow in this area is always from Cat Lai to Phu Lam and supply from Phu Lam will increase construction cost and power loss, and cause larger voltage drop.

  - The 220kV line to Bac Lieu shall be originated from Thot Not instead of the planned Rach Gia. The 220kV line between Thot Not and Rach Gia will be heavily loaded and the direction of power flow on this line is always from Thot Not to Rach Gia and not suitable for further loading the load of Bac Lieu line.

- The planned conductor size of the Omon - Thot Not line, 2 circuits of AC400, is clearly not sufficient. To send generation of 900MW, at least duplex conductors of AC400 are required.

- For the section between Long Binh and Bao Loc, double circuit line is required when the Dai Ninh hydropower plant is connected, and the second circuit is required when the Dong Nai 4 hydropower plant is connected. The existing line in operation since 1964 can be replaced.

- In the period of 2006 to 2010, the following three existing lines will require replacement with duplex conductor lines:

  . Long Binh - Thu Duc: 2 circuits are required
  . Thu Duc - Hoc Mon: Same as above
  . Phu My - Long Thanh: Planned 2 circuits of AC400 do not have enough transmission capacity.

- Though details shall be further studied, for supply to the Ho Chi Minh area two additional substations will be required to meet demand up to 2010. One of these substations will be required in the city center area, most probably this station will be of GIS construction and connected with underground cables.

- One substation will be required at Tay Ninh to meet growing demand in the area. Other two substations are anticipated to be required in the period of 2006 to 2010 in the southwestern parts of the region.

- Extension of the existing 500kV system is required to secure power supply to the Ho Chi Minh area and to the Mekong delta. The 500kV system extension was assumed in this study as mentioned below:

  - Two substations were planned at Bao Loc and Cat Lai on the second 500kV line between Pleiku and Phu Lam. A 150MVA reactor was connected to the Bao Loc bus to compensate line capacity. A transformer at Bao Loc was connected in the period of 2006 to 2010, when the Dong Nai 4 hydropower plant is connected, to provide a detour route to the 220kV system in the area.

  - From Phu My, two 500kV lines, to Phu Lam and to Cat Lai, were assumed to transfer the generated power of the Phu My thermal power plant together with power from the Phan Thiet thermal power plant. A loop line system is considered between Phu My and Phu Lam to attain reliability of power transfer.

  - The 500kV extension to Thot Not will be required just after 2000. The currently planned transmission lines to Tra Noc, Thot Not and Rach Gia are not adequate to transmit the forecasted 2000 demand normally, and static capacitors of 110MVA in total will be required at Thot Not and Tra Noc to maintain the normal voltage.

  - For delivery of the generated power of the Phan Thiet thermal power plant, 2,100MW, a two circuit line to Phu My and a detour line to Bao loc were taken into account.

- To avoid voltage drop of the Ho Chi Minh system as a whole, it is needed to install static capacitors of approximately 300MVA in total on the tertiary windings of 500/220kV transformers. In the power flow calculation of this study, installation of static capacitors was assumed, 100MVA at Cat Lai and 150MVA at Thot Not.

(c) Central System

- For connection of a series of hydropower plants, cascade connection is considered for the sections of Pleiku - Sesan 3 - Sesan 4 hydropower plants and Pleiku - Pleikrong -Thuong Kontum - Quang Ngai.

- Buon Coup, Rao Quan and Son Con 2 hydropower plants are assumed to be connected to the 110kV system.

- Situation of the power supply to Nha Trang by the planned 220kV lines from Pleiku via Krong Buk and from Da Nhim is critical in 2010. To increase power transmission capacity to meet the future demand in the area, further addition of 220kV lines will not be effective and an extension of the 500kV system by branching from the second line between Pleiku and Bao Loc is recommended. This line will be required just after 2010.

(5) Identified Transmission System Extension Plans

220kV transmission system extension plans of this study up to 2000, 2005 and 2010 are shown in Tables 10.2 and 10.3 for the northern system, Tables 10.4 and 10.5 for the southern system, and Tables 10.6 and 10.7 for the central system. These tables indicate addition plans identified as the result of system analysis of this study together with the fourth M/P. A presumed plan of 500kV system extension is presented in Table 10.8.

The planned additions during the five year periods of 1996 - 2000, 2001 - 2005 and 2006 - 2010 of the three regions of northern, southern and central are shown in Figures 10.13 through 10.21.

10.3 110kV and Distribution Systems

It is not practical to estimate actual requirements of these items from available information, and necessary additions for each year were estimated based on the forecasted annual increment of energy sales and estimated installations for GWh sales. In decision of future requirements, not only figures of Vietnamese power system but also figures in other similar countries were taken into account.

Estimation of each item is explained below:

(1) 110kV System

Actual installations for GWh power sales as of end-1994 were calculated for each regional system from the actual quantities at the end-1994 not including private facilities and the estimated energy sales. The length of 110kV lines in circuit-km and transformer capacity in MVA per GWh sales of each system are as given below: